Engaging the 'Xbox Generation of Learners' in Higher Education

Mary Sheard and Jebar Ahmed

University of Huddersfield
School of Education and Professional Development

Report prepared for HEFCE and the University of Huddersfield

October 2007

About the authors

Mary Sheard is a Research Fellow at the University of Huddersfield. Mary has recently submitted her thesis on teacher learning through critiquing video, which she undertook as a doctoral student at the University of Nottingham. Previously, Mary worked as an advisory teacher and educational consultant with a local authority, and, prior to that, as a Primary school teacher.

Jebar Ahmed is the Learning Technology Adviser at the School of Education and Professional Development at the University of Huddersfield. Jebar is responsible for the development and implementation of e-learning strategy within the School and is a key player in the University's strategy group. Jebar also teaches on e-learning and teacher training courses in the School. Having worked in the Banking sector, Jebar has several years of experience in IT systems, Virtual Learning Environments and Learning Technology in both the private and public sector.

The authors may be contacted at the following e-address:
m.sheard@hud.ac.uk
j.ahmed@hud.ac.uk

For further information and electronic copies documentation you can visit the project webpage at: http://www.hud.ac.uk/edu/projects/xbox.html

Acknowledgements

The authors wish to thank the following people for their help and co-operation during the research project:
Pupils and teachers in the participating Secondary schools;
ICT consultants in Barnsley and Kirklees Local Authorities;
Students, tutors, researchers and learning technology advisers at the University of Huddersfield who participated in the study;
Teaching staff from Huddersfield College who participated in the study;
Zafer Ali and Tom Anderson from the University of Huddersfield, for their technical support.

Table of Contents

Illustrations

Tables

Figures

Images

1 Executive Summary

1.1 Introduction

The research project identifies examples of technology used to empower learning of Secondary school pupils that could be used to inform students' engagement in learning with technology in the Higher Education sector.

Research was carried out in five partnership Secondary schools and one associate Secondary school to investigate how pupils learn with technology in lessons and to identify the pedagogy underpinning such learning. Data was collected through individual interviews with pupils, group interviews with members of the schools' councils, lesson observations, interviews with teachers, pupil surveys, teacher surveys, and a case study of a learning event.

In addition, data was collected on students' learning with technology at the university through group interviews with students and student surveys in the School of Education and Professional Development, and through surveys completed by students across various university departments.

University tutors, researchers, academic staff, learning technology advisers, and cross sector partners from the local authority participated in focus group interviews on the challenges facing Higher Education in engaging new generations of students, who have grown up in the digital age, in successful scholarly learning.

1.2 Findings

1. The use of the Internet was evidently embedded in practices across participating Secondary schools. Key Stage 4 pupils appear to have wider access to computers in lessons than other pupils. This is to support their course work for GCSE and BTEC national examinations. The range and use of additional learning technologies in lessons appeared to be limited and either developmental or peripheral. Developmental learning technologies were; the use of the interactive whiteboard as a learning tool; the institution's virtual learning environment; the use of computer games as a learning platform; the use of e-mail, and e-learning for independent study. Peripheral technologies were the use of educational computer games for revision; videos; and computer-based mind-mapping.

2. Situations where engagement in learning was evident due to the use of technology showed that pupils used the technology as a cognitive tool, an organising tool, and, to a lesser extent, as a social tool for learning. Pupils consider technology to be a cognitive tool and an organisational tool or learning. While pupils see the main functions of technology to be accessing information and improving their work, presumably through correcting and redrafting, they also associate technology with conceptual development and critical thinking, although to a lesser degree.

3. Findings illustrated ways in which pupils' learning with technology reflected the information age mindset identified by Frand (2000). Additional attributes of the mindset for the generation of Secondary school learners who participated in the study were their preferences for autonomous learning, personalised learning, interactivity, exploratory learning through trial-and-error, creativity, appropriation, and customisation of the technology.

4. When using computer technology in lessons, pupils appeared to be more comfortable, confident, relaxed, motivated and engaged as learners. Observations suggested that pupils were also more on task, more organised and less distracted. In this sense, access to the computer provided a 'natural' condition for learning and supported several positive features associated with learning. However, negative characteristics were associated with the concept of 'powering down' in lessons, and with restricted or problematic access.

5. Where pupils were learning effectively with embedded, developmental and peripheral technologies used in lessons, there was evidence of multiple indicators of pupil engagement in learning and multiple pedagogical approaches for engagement in learning using technology.

6. The case study illustrates how the technology promotes high order cognitive activity, and challenges the notions that technology makes learning 'easier'. From the case study findings, the following features of pupil engagement, including conflict resolution and learning moves, were identified in problem-solving learning:
adapting and customising the technology;
supporting collaborative teamwork within groups;
supporting dialogic learning;
enhancing the pace of pupils' responses to tasks;
supporting high levels of concentration and perseverance;
supporting conflict resolution;
supporting creative thinking;
promoting critical reasoning;
prompting decision-making;
organising work through saving and editing;
promoting evaluating, describing, explaining, questioning, arguing, and defining.

7. In the case study on collaborative problem-solving learning with technology, while pupils' use of technology led to purposeful oral communication within groups, the discussion board did not prove to be an effective social communication tool to support collaborative problem solving between groups. This finding suggests that, even though pupils may communicate extensively with each other in social contexts using technology in their leisure time, effective communication between pupils for learning with technology in collaborative problem solving contexts can not be taken for granted. There was some evidence that, in providing limited information and limited emotional expression, discussion board posts were difficult to interpret and respond to in problem-solving tasks.

8. In examples of good practice, Secondary school teachers were developing uses of technology as a cognitive tool in lessons. In particular, technology was used effectively to promote personalised learning. Opportunities were provided for pupils to access technology when required to support initiative and ownership in learning, and a seamless use of technology in and out of lessons was supported.

9. Findings from the University student survey suggest that technology provides students with an important cognitive, social, and organising tool for engagement in learning. However, technology was reportedly used least often to structure ideas, to critically evaluate ideas, or to communicate with others to develop understanding. This suggests a mismatch between the provision and deployment of technology for engaging learning currently in university courses and what new generations of students might expect and require.

10. The following themes emerged in interviews with university students about the use of technology to support their learning in taught curriculum time: disengagement through an over-use of PowerPoint; the need to ensure quality of resource provision; lack of differentiation in teaching; the need to develop, manage and apply information literacy; the need to increase engagement through interactivity; the importance of email and text messaging as social and organising tools for learning; positive and negative features of Blackboard, the university's virtual learning environment (VLE); the usability and usefulness of Metalib; and advantages and possible developments of the Associate Online Collaborative Project's shared virtual learning environment (VLE).

11. University staff and cross-sector partners identified the need for a cultural change in redefining learning and teaching for engaging future learners in Higher Education. This would

involve a change in emphasis from learning outcomes to learning processes and the need to embrace innovative practices for interactive learning, including the use of popular social technologies. A changing role for academic tutors was identified in the development of information literacy to support good scholarship using technology. Such changes would require a strategic focus.

12. Discontinuities between sectors in learner experiences with interactive whiteboards and virtual learning environments (VLEs) were a cause for concern. The development of technology-based learning, and information literacy in particular, was regarded as perhaps the most important issue for transitional pedagogy between educational sectors by cross-sector participants.

13. Teacher educators identified challenges and possibilities around the relationships between e-learning, blended learning and face-to-face learning. Possibilities and constraints were identified in the use of social technologies for engaging learners. Suggested future strategies included the development of online networks and virtual environments for enhancing learning opportunities. Short-term improvements in targeting support and providing for students' preferred learning approaches could be achieved by establishing knowledge of students' technology skills and learning approaches on entry to university.

14. Priorities identified by Learning Technology Advisers were putting the pedagogy into the technology; developing cross-sector and cross-institutional partnerships for sharing and building on good practices; addressing issues of usablity around students' use of Blackboard, the university's virtual learning environment (VLE); and providing appropriately targeted technological support for students.

1.3 Recommendations for developing teaching strategies for engagement in learning:

The following sets of recommendations are drawn from the findings of the research with Secondary school pupils, from the case study, and with the different participant groups. The recommendations suggest ways to maximise opportunities for empowering learning, and to minimize students' disengagement in learning through 'powering down'.

i) Recommendations from the research with Secondary school pupils:

Maximise the range of pedagogical approaches for engaging pupils /students in learning with technology;
Recognise and support the dissemination of good practice in the provision for pupils/students to learn with embedded, developmental and peripheral learning technologies;
Seek to develop the use of technology as a cognitive, organising and social tool for learning;
Increase opportunities for technology to be used as a social tool for learning;
Recognise pupils'/students' learning preferences, their learning mind-set, and how they operate as learners. In particular, explore ways to best support learning with technology in reference to preferences for autonomy, personalised learning, interactivity, exploratory learning through trial-and-error, creativity, appropriation, and customisation;
Consider how a focus on cognitive activities such as describing, explaining, evaluating and arguing may support meaningful interaction with and transformation of information and reduce plagiarism.

ii) Recommendations from the case study:

Support pupils in evaluating, describing, explaining and arguing through the medium of technology for learning;
Support students' creative customisation of technology in support of learning;
Develop the use of technology as a social communication tool in online problem solving contexts;
Develop the use of discussion boards and similar social technologies for collaborative e-learning and problem solving;
Recognise and, where possible, accommodate pupils' adaptations that increase fitness for purpose and improve the capability of the technology as a learning tool;
Explore creative ways in which pupils may use technology to manage conflicts in collaborative and distributed problem solving contexts;
Give close attention to stages and features of engagement in learning with technology, identified in the case study, to maximize opportunities for learning;
Provide for the learner's entitlement to both private and public engagement in learning with technology.

iii) Recommendations from interviews with Secondary school teachers:

Keep up to the technology and the way students engage with it, and use it as an educational tool;
Provide open access to computer technology in taught curriculum time for researching or processing information, and explore the seamless use of technology in and out of taught curriculum time;
Increase learners' opportunities for interactivity and social learning through connecting laptops and projectors/interactive whiteboards in teaching spaces;
Use video technology to support critical thinking skills and improved learning outcomes through assessment for learning;
Use generic mind mapping computer software to support conceptual development and thinking strategies;
Use Interactive Whiteboards as learning tools through which pupils manage, manipulate and communicate ideas:
Fully exploit the potential usability and interactivity of the institution's server and website to maximise students' engagement in learning.

iv) Recommendations from interviews with university students:

Introduce different styles of presentation and different methods of delivery using technology to increase student engagement through interactivity, avoiding 'death by PowerPoint';
Consider how technology might free up taught curriculum time for engaging students in important learning;
Change the current emphasis in the use of technology from a teaching tool to a learning tool, for example, the use of PowerPoint and the Interactive Whiteboard;
Improve the navigation of Blackboard;
Extend the function of the university's VLE as a repository to an interactive resource for stimulating academic discussion;
Achieve an appropriate balance between the 'virtual/hands off' nature of students' learning provided by the VLE and students' need for more social interaction to develop their understanding/cognitive engagement;
Give more recognition to students' prior experiences, expertise, technological skills and learning needs in teaching for personalised learning;
Make specialist software more accessible where possible;
Minimise induction requirements through a more differentiated approach;
Develop information literacy and criticality for deep learning;
Embed and fully exploit email and text messaging as social and organising tools for learning.

v) Recommendations from university staff and cross sector partners:

Connect learning processes to and through the popular social technologies with which new generations of students engage;
Accommodate the new learning styles that students are developing with technology;
Speak to current and prospective students to find out what learning technology they want and what they expect from the university;
Undertake further research to identify authentic learning contexts for mobile and social technologies, and to inform how they might best be integrated into scholarly learning;
Use interactive content that is web deliverable;
Identify and implement strategies for supporting good scholarship and information literacy using technology.

vi) Recommendations from teacher trainers:

Gain knowledge of students' technology skills prior to the start of courses to inform teaching, accommodate learning approaches, and target technological support where it is required;
Where possible, reduce organisational constraints preventing the creative uses of social technologies to support students' learning;
Increase access to resources to provide for a seamless use of learning technology in taught sessions;
Investigate the advantages of developing a virtual classroom as a resource for engaging future generations of trainee teachers in learning about pedagogy;
Redress a perceived over-emphasis on text-based material on Blackboard by introducing more creative, visual presentations to meet the needs of learners;
Develop and extend the discussion forum and file sharing facilities of Associate Online as a resource for students to explore and extend their subject specialist knowledge and their professional identity in a community of learner practitioners.

vii) Recommendations from learning technology advisors:

Focus provision on learners' needs;
Explore ways in which the University's VLE should develop to meet the requirements of interactive and social learning;
Explore how social communication technologies might be used effectively to support scholarly learning;
Research and respond to students' views on learning with technology and the ways in which technologies impact on their learning;
Research and seek to accommodate the technology-based learning behaviours and expectations of future generations of university entrants;
Develop cross-sector and cross-institutional partnerships to inform pedagogy and ensure continuity in good practices in technology-based learning;
Monitor the relationship between students' management of digital technologies and the quality of their learning.

2 Introduction

This section presents the rationale for the research project, a review of the related literature and an outline of the methods of data collection and analysis used in the project.

2.1 Rationale for the research project

The present research project stemmed from the observation that there appeared to be little existing research to inform how institutions in the Higher Education sector should be developing teaching to accommodate the technology-based learning approaches and preferences of new generations of learners who have grown up in a digital world. Examples of good practice in engaging Secondary school pupils in learning with technology in class supported the project aim, to identify a research-informed 'transitional pedagogy for technology-supported learning'. This pedagogy is a feed forward of skills for engaging learning with technology in taught curriculum time across educational sectors from Secondary schools to universities. The project therefore investigated the technologies and associated teaching methods used to engage learners in Secondary schools, and how similar technologies and methods may be used in the Higher Education sector, particularly in teacher training. The research was undertaken in six schools and colleges in the Secondary sector, in the School of Education and Professional Development at the University of Huddersfield, and through surveys completed by students from across the University. The project's focus on the technology-supported learning experiences of teacher trainees in taught curriculum time recognised the potential influence that this group of students may have on future generations of learners in schools and colleges, as well as the changing learning needs of this particular diverse constituency of students (Oblinger, 2003).

One of the project's main targets was to inform an action plan and training guidelines for the School of Education and Professional Development at the University of Huddersfield, to match the quality of teaching and learning in lectures, seminars, workshops and tutorials to the needs of new generations of teacher trainers. Based on the research findings, the project aimed to present recommendations that will inform the development of technology-based teaching and learning strategies across the university as a whole. In this way the project intended to ensure that teaching in the academy is informed and enriched by research (HEFCE, 2006) and accommodates students' learning needs in the best possible ways, thereby ensuring that students are successful in their studies (HEFCE 2006).

The research project was closely aligned to the university's developing Teaching and Learning Strategy that seeks to be customer oriented, to encourage a critical self-evaluative culture that is able to identify and disseminate good practice, and to invest in excellence by encouraging pedagogic innovation and the use of new technologies in a research-informed environment. Similarly, the project aimed to inform teaching practices that might improve student recruitment and retention through the principles of transitional pedagogy and engagement in learning and their reality in practice.

As the project progressed, it became clear that a range of participation should be included from different stakeholders and interest groups. The project, therefore, included the participation of a Secondary school pupils, Secondary school teachers, university students, university tutors and lecturers, academic researchers, learning technology advisers, a Pro Vice Chancellor, Further Education College tutors and senior managers, local authority education consultants for information technology. The focus of the study appeared to be timely and relevant for the different participating groups, and to present them with important challenges.

The research project's findings and sets of recommendations are based on individual and group interviews, lesson observations, a case study and pupil and student surveys. Findings and recommendations from different participating groups are reported separately in order to capture the different perspectives and proposals for engaging new generations of learners in higher education.

2.2 Related literature

There is currently an extensive research interest in learning with technology in the different educational sectors, and particularly in Higher Education. This growing interest is reflected in the wide-ranging sample of current e-learning research questions, identified by Conole et al (2007), which are informing the research agenda at the present time. Of particular relevance are the pedagogical research questions Conole et al (2007: 16) identify around understanding the learning process, which include the following:

What is effective pedagogy in terms of using learning technologies?
What are the inherent affordances of different technologies?
What forms of collaborative activities were occurring and how can these be supported?
Are current teaching and assessment practices appropriate in an e-learning context?
Will the use of ICT result in new forms of pedagogy?

The questions above suggest a sense of urgency in developing our understanding of learning with technology and, in particular, how to engage learners in scholarly learning using technologies in the university context, both now and in the future. The research questions have wide-reaching implications for the development of a university's teaching and learning policy and e-learning strategy at a time of unprecedented investment in ICT access and capability, as the following recent communication indicates:

> *We are pleased to announce that from the start of term student wireless access to the web and SAN home folders will be available from across the whole of the Queensgate site and at the Barnsley and Oldham Centres. This new service is aimed principally at students who bring in their own laptops, but will also be available to staff and affiliates, in fact to anyone who has been provided with a username and password to log in to the network. The service will replace a number of existing independent wireless networks across campus with a single 'cloud' which will give access, eventually, from all University buildings and from the open spaces between them.*
>
> *We believe that the wireless cloud will bring a number of significant benefits to the University… it will add to the University's growing inventory of state-of-the-art facilities…It will give students the flexibility to use their own laptops where they choose including in the grounds and in social spaces. It also frees them from dependency on fixed I.T. links which as we know is sometimes a limiting factor at critical periods in the academic year* (Huddersfield University CS Bulletin, September 2007).

A decade ago, Hannafin et al (1997) suggested that the unique potential of the technological learning environment is the extent to which it supports or alters cognitive processes. Learners may use technology to derive problems, vary solutions and expand the boundaries of their understanding (Hannafin et al, 1997:187). However, Hannafin et al (ibid) remind us that while technology may afford the opportunities for cognitive processes, technology may not be used 'mindfully' (Salomon, 1986) by the learner to extend thinking or understanding. How learners use technology 'mindfully' to promote cognitive activity for learning in formal educational settings remains an open question. Prenski (2001) coined the term 'digital natives' to describe the first generation to grow up with digital media in multiple forms (Barbaux, 2006). These learners are said to access, absorb, process and use information differently from earlier generations (Prenski, ibid). Lohnes et al (2007), after Prenski (2001), suggest that changes in teaching in Higher Education will be driven by students' expectations about the role of technology in teaching, and by their own learning requirements. Lohnes et al (ibid) argue that there is a need for more research into the 'why' and 'how' of students' technology practices supporting learning, and the influence of learning contexts on those practices.

As universities currently refine their vision statements and introduce policies to harness learning with technology with a view to attracting and retaining future generations of students, there is a growing awareness of the changing learning approaches and preferences of different generations of students. Barbaux (ibid), for example, suggests that the generation of students born into the age of digital technology bring with them a significantly different approach to learning based around access to multiple and instantaneous sources of

information, multitasking, and being socially connected to peers through mobile devices (Barbaux, 2006:132).

Oblinger (2003) highlights the challenges in accommodating and providing for the learning styles, attitudes and approaches of different generations of learners by asking the important questions 'How well do college and university faculty, administrators, and staff understand these differences? How often do they take the differences into account when designing programs or courses?' Oblinger (2003: 38) argues that the Millenial generation, who were born in or after the year 1982, the year the PC was introduced, exhibit different attitudes and values and exhibit different learning preferences characteristics from those of siblings just a few years older. Millenials, for example, prefer teamwork, experiential activities, structure, and the use of technology. Their strengths are said to include multi-tasking, goal-orientation, positive attitudes, and a collaborative learning style (Raines, 2003). In research reported by Oblinger (2003:39) many pupils between the ages of twelve and seventeen were disappointed with the use of technology in school. The pupils considered their teachers' use of technology to be uninspiring, and reported seeing better ways than their teachers to use the technology. Administrative restrictions and old or low specification equipment inhibited their effective use of technology in school (Levin et al, 2003).

Oblinger (2003) argues that an essential component of facilitating learning is understanding learners (Oblinger, 2003: 37). This consideration would seem to preface any inquiry into how technology can be used more effectively to support learning (Becta, 2007). In particular, the need to understand learners and their learning prompts questions about the learning approaches and preferences of the 'Xbox generation of learners', or the new Millenials, who may be the next generations of university students. Recognising, after Oblinger et al (2005), that students of the 'Net generation' have distinctive proficiencies informed by their intensive use of information technologies, Sword et al (2007) propose the following set of principles to support students' cognitive processes: relinquish authority; recast students as teachers, researchers, and producers of knowledge; promote collaborative relationships; foster critical creativity; create multiple intelligences; encourage resilience and welcome challenge. These principles may provide a useful framework for investigating developments in teaching and learning with technology.

The Harnessing Technology schools survey 2007 (Becta, 2007), of ICT in schools, indicates that the diversity of application of ICT resources in classrooms in Primary and Secondary schools is relatively limited, that ICT is mostly used for whole class activities, and that only a minority of teachers encouraged the use of social software by their learners. In addition, the survey found that the majority of teachers considered that the use of ICT in the classroom positively impacts on the engagement and achievement of learners. The results of the survey would therefore seem to suggest that learners in Secondary schools at least may continue to be disappointed by what some have described as 'powering down' in classrooms (Puttman, 2007). 'Powering down' refers to pupils' feelings of disengagement in learning because their preferred technologies and the technological skills they have acquired are not provided for in current teaching and learning methods in schools (Puttnam, 2007). 'Empowering learning' may therefore be the opposite scenario to 'powering down', where technologies that pupils use effectively outside the classroom in their personal learning and leisure are used to enhance learning in the curriculum.

An interesting perspective on the generational differences outlined above is the development of an 'information-age mind-set' or the attitudes and aptitudes of learners who have grown up in the digital world, as described by Frand (2000). The attributes of the mind-set identified by Frand (ibid) are as follows: computers aren't technology; the internet is better than TV; reality is no longer real; doing is more important than knowing; learning more closely resembles Nintendo than logic; multi-tasking is a way of life; typing is preferred to handwriting; staying connected is essential; there is zero tolerance for delay; and consumer and creator are blurring, the assumption often being that if something is digital, it is everybody's property (Frand, 2000).

Research reports currently available on learning with technology focus mainly on the FE and HE sectors. One exception is the evaluation of the DfES ICT Test Bed Project on learner perceptions of the impact of ICT on their education by Jarvis et al (2005). Using data through group interviews and learner logs, Jarvis et al (2005) investigated learners' perceptions of the impact of ICT on their education in Primary schools, Secondary schools and Further Education colleges. While the report did not take a close look at pupils' approaches to learning with technology, or their learning outcomes, it made a useful contribution to understanding the new millennial generation of learners. The main findings from the Secondary school pupils' perspectives on the use of ICT in their education, outlined below, provide a platform from which pupil learning with technology might be explored further. Jarvis et al (2005) found that pupils were generally very positive about the impact of ICT. All pupils considered that computers had helped their studies and had motivated them to learn, but some felt that the momentum had been lost. Pupils reported variable access to ICT, depending on the subject, the teacher, the time-table, and the location of the lesson. Pupils wanted more influence on what was presented on the school website, and more autonomy in the use of the computer equipment. Many students were ambivalent about ICT in teaching and learning, felt impatient when the teacher was showing them what to do, and looked forward to a time when they might have their own individual computer in school and the teacher could just log in and check work. (Jarvis et al, 2005: 24).

Recent reports focus on the learning of students in educational sectors other than the Secondary school sector and offer important insights into the current experiences of different generations of learners using technology as a cognitive, organising and social tool for learning. The reports may, therefore, inform our understanding of the complex relationship between technology and learners generally (Martin et al, 2007). For this reason, the findings from three reports making an important contribution to the field are outlined below.

The LEX Report, The Learner Experience of e-Learning (Creanor et al, 2006), adopted a learner centred focus to investigate learners' experiences and expectations of e-learning across the broad range of further, higher, adult, community and work-based learning. Variations between learners within sectors were reported, as were similarities between learners across sector boundaries. Characteristics of effective learning in e-learning contexts included meta-cognition, where the learner understands how they learn; high levels of motivation and a positive attitude to both learning and technology; the ability to capitalise on the technology for informal as well as formal learning; the confidence to overcome pedagogical and technological difficulties; and the capacity to use the technology for networking with friends, peers, family and tutors to build up personal support structures necessary for their learning (Creanor et al, 2006:26). Additional findings relevant to the present study were that learning with technology impacts on learners' confidence and self-esteem and influences how they interact with others. Moreover, effective learners displayed the confidence to use their own preferred learning strategies with technology and to personalise their virtual and physical learning environments. Increased engagement in learning was associated with learners having choice and control over their learning environment through the affordances of technology. Importantly, a link was identified between tutor engagement with e-learning and learner attitudes to their own learning (Creanor et al, 2006:26, 27).

The JISC LXP report on university students' experiences of technologies (Conole et al, 2006) usefully provides empirical evidence of students' learning environments. However, the findings relate mostly to learning environments in 'white curriculum time' (Ward, 2007), or time that is not designated as lecture, seminar or tutorial time. The nature of student experiences of technologies for learning in taught curriculum time is much less clear. Similarly, the relationship between learning with technology in 'white curriculum time' and in taught curriculum time is not well understood. The value of the report is in highlighting the centrality of technology as a cognitive, organising and social tool for learning in students' designated study time. Across all subjects, students made extensive use of personally owned technologies including mobile phones, laptop computers, personal digital assistants and USB memory sticks. Similarly, students were found to use a range of standard packages such as

Word and PowerPoint for creating and presenting learning artefacts and assignments and for manipulating textual and numerical data. Students were found to synthesise and integrate information across multiple sources of data in sophisticated ways. In particular, evidence indicated that students were appropriating technologies to meet their personal needs, for example, mixing the use of general ICT tools and resources with institutional tools and resources.

The following findings reported in the JISC LXP report would seem to be of particular interest for the present study:

Students in the study considered the PC to be their central learning tool, they were used to having easy access to up to date and relevant information and resources, considered this essential for learning, and expected the same on their courses;

New working practices appeared to be emerging where students use an integrated range of technological tools for gathering, using and creating knowledge;

A shift was detected from lower to higher levels of cognitive activity, enabling students to make sense of their learning;

Students were combining the technologies, synthesising and re-appropriating, checking meaning and understanding with others, self-reflecting, and evaluating;

In addition, the JISC LXP report highlighted the following components of students' learning with technology: assimilation, information handling, manipulating and presenting information in different ways, communicating new ideas, producing learning artefacts, and exploring and applying concepts.

The SOLE project investigated education students' online learning experiences (Timmis, 2004). Education case studies in the project were used to explore student online learning experiences, student behaviour and the impact that tutor conception of learning has on the students' experience (Harrison et al, 2004). Findings from the SOLE project suggested that social constructivist approaches to learning lead to online learning and impact on student experience. Structured activities and high levels of tutor support were found to influence the extent of students' motivation to engage in online collaborative communications.

The reports referred to above provide snap-shots of different generations of learners' engagement with technology for learning in different learning contexts. Returning to the challenges in accommodating and providing for the learning styles, attitudes and approaches of different generations of learners, the reports illustrate the complexity of learning with technology and the challenges facing schools and universities in preparing to meet the learning needs of future generations of learners. There appears to be very little classroom-based research evidence currently available to inform HE on how to provide for and build on the particular learning approaches, preferences and attitudes of today's Secondary school pupils when they enter universities as undergraduates.

Somekh (2007: 33) argues that until all students have their own personal 'digital learning companions' and access to the Internet wirelessly and when required, the usefulness of technology for learning will inevitably be constrained. Similarly, a new pedagogic understanding of the role of technology for learning needs to emerge if teaching and learning are to be successful (Somekh, ibid). Such an understanding would view technology as a cognitive tool, providing ideas and a resource for enquiry, and, perhaps most importantly, as a support for creativity in learning (Somekh, 2007:101)

In developing the theme of engaging learners through the use of technology as a cognitive tool, it may be useful to juxtapose applications of learning theory to e-learning (Dyke et al, 2007) to pedagogic criteria for learner engagement (Pianta et al, 2006). In this way, we may be able to envision and provide for learning with technology that permits learning through thinking and reflection, learning through experience and activity, and learning through conversation and interaction (Dyke et al, 2007). Specifically, it may be useful to consider how pedagogical approaches for engagement, focussing on instructional learning formats, content understanding, analysis and problem solving, and quality of feedback (Pianta et al, 2006), may transpose to engagement for learning with technology. Examples of these approaches, based on the work of Pianta et al (ibid) are presented in Table 2.1.

Table 2.1: Pedagogical approaches for engaging learners (Pianta et al, 2006)

The focus of pedagogical approaches for engagement in learning and associated teaching strategies
Instructional learning formats (or what the teacher provides through activities, tasks, materials to maximise student engagement and opportunities to learn): Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness, exploration, inquiry, and manipulation of and interaction with content
Content understanding: The teacher's focus is primarily on meaningful understanding of big ideas and concepts, or broad frameworks and key ideas, through a variety of rich and appropriate positive examples and contrasting non-examples; Teaching explicitly links new concepts and big ideas to students' background knowledge; Teaching effectively makes use of different perspectives; Demonstrates/presents deep subject knowledge and expertise
Analysis and problem solving: Teaching emphasises analysis, integration, and application of knowledge and skills through problem solving, reasoning, and experimentation; Teaching provides opportunities for meta-cognition; Teaching promotes prediction, experimentation, and brainstorming; Teaching regularly models opportunities for meta-cognition
Quality of feedback: Provision of feedback, including peer review, focussed on expanding or extending learning

In reference to the literature outlined above, a useful focus for research would seem to be the current nature of learner engagement using technology as a cognitive, organising and social tool. In particular, review of the literature suggests that more research is required into the learning approaches and preferences of Secondary school pupils. The requirement is to inform appropriate preparations for engaging this particular generation of learners for their successful engagement with learning as they progress into the Higher Education sector.

2.3 Methods of data collection and analysis

The study takes a socio-cognitive perspective on student learning with technology. The theoretical framework underpinning the study draws together a cognitive theory of learning around critical knowledge building activity such as describing, explaining, and arguing (Ohlsson, 1995), perspectives on learning with technology (Conole et al 2007) and effective pedagogies for engagement in learning (Pianta et al, 2006).

A mixed-methods approach was used. The research was conducted in five partnership Secondary schools in three different local authorities, in an associate school in a fourth local authority, in the School of Education and Professional Development, and across other university departments at the University of Huddersfield. Data collection in Secondary schools was through lesson observations, semi-structured interviews with pupils in lessons, focus group interviews with pupils, pupil surveys, interviews with teaching staff, teacher surveys, and a case study. The data set was based on field notes and audio-recorded interviews, which were transcribed and analysed using Audacity and Escribe software. The data was analysed to indicate examples of learning or learning moves represented in pupils' interview conversations as they described and discussed their work in lessons. Examples were sought where pupils used technology as a cognitive, organising or social tool for learning. Interviews with teaching staff focussed on examples of pedagogy for pupil engagement in learning with technology. Lesson observations identified examples and uses of learning technology in lessons.

The case study focused on a day visit by a group of eight Secondary school students to the School of Education and Professional Development at the University of Huddersfield. It

sought to investigate the students' engagement in learning using technologies in the university setting. In particular, the case study aimed to investigate the conversations, discussions and arguments surrounding the students' engagement with the technologies that might lead to problem-based learning. The main part of the students' visit focused on two activities, one using voting pads and the other based on collaborative problem solving. The activities were chosen to provide interactivity in contrasting learning contexts.

Data collection in the university was through groups interview with students, student surveys, focus groups and interviews with lecturers and tutors, and interviews with other key players including tutors, researchers, academic staff, and Learning Technology Advisors. Representatives of a partnership local authority and a Further Education college participated in cross-sector group interviews. Interviews focussed on the perceived challenges facing the university sector for engaging new Millenial generations of students in learning. Analysis of interview responses was through coding against emerging themes. The majority of surveys were analysed using Bristol Online Surveys provided by the University of Bristol.

The next section reports findings on how Secondary school pupils learn with learning technologies.

3 How pupils in Secondary schools learn with technology: evidence of school-based learning

The first part of this section gives an overview of technology supporting learning in the participating Secondary schools. Next, the roles technology performs as a cognitive tool, a social tool, and an organising tool for learning are highlighted, using earlier research findings by Frand (2000) on identifying attributes of an information-age mindset as a framework. The third part of the section considers how findings from the pupil survey may inform our understanding of learning with technology in the Secondary school sector. Following this, examples of good practice in using technology to support pupil engagement in learning are presented. The examples are identified and discussed using a framework of pedagogical approaches for engagement and indicators of pupil engagement with technology adapted from Pianta et al (2006) and Becta (2007). Conclusions are drawn from the findings in the penultimate part of the section, where the concepts of 'powering down', 'technology-empowered learning' and 'transitional pedagogy' are highlighted. Finally, recommendations are suggested.

3.1 An overview of technology supporting pupil learning in the participating schools

The research project 'Engaging the 'Xbox generation of learners' in Higher Education' was based on the assumption that developments in pedagogy in the University might usefully be informed in part by the learning experiences of the digital generation of learners currently being educated in Secondary schools. The study recognises that this particular generation will also have used technology to support their learning at Primary school and possibly quite extensively in their leisure time from an early age (Oblinger, 2003). The study was therefore interested to investigate how Secondary school pupils are currently learning with technology in their lessons.

Six institutions from the Secondary school sector took part in the research. The institutions were Secondary schools or colleges in four local authorities. Two had specialist school status. Five of the participating schools and colleges were existing partners with the University and were selected in consultation with local authority education advisers. The sixth institution was invited to be an associate in the research on the basis of its reputation for excellence in the use of technology to support learning and particularly in the development of the school's Virtual Learning Environment (VLE), which is currently being developed further. The adoption of effective methods of technology integration in the curriculum, adapting to pupils learning styles, had been recognised by OFSTED reports and local authority monitoring in at least four of the participating schools and colleges.

Fourteen days were spent collecting data through observations and pupil interviews in 53 lessons in the following curriculum areas: Mathematics; English; French; German; Science; History; Art; Business Studies; Personal, Social and Health Education; BTEC sport; and ICT. The pupil data set consisted of 101 short semi-structured interviews with pupils in lessons, seven group interviews with members of School Councils, and 469 pupil surveys (see Appendix 1, Pupil survey).

In this study pupil learning was conceptualised as a change in understanding, an increase in knowledge, or the production of a new idea or artefact as a result of a technological process or event. Pupil learning in these ways is represented through the pupil's discourse around engagement with the technology or through an outcome of technological use. Lesson observation field notes were scrutinised for examples of good practice where technological provision was associated with pupil learning.

Interview data was analysed using descriptors of learning with technology suggested by Conole et al (2007) as lenses to investigate how technology might support learning as a cognitive tool, a social tool, and an organising tool. The surveys provided statistical

information in the form of numbers and percentages of pupil responses about their perceptions and uses of technology to support their learning in lessons and in homework.

Technological provision to support pupil learning at the time of the project was similar between the participating schools and colleges. Computer rooms were time-tabled for different subjects and predominantly for ICT. Interactive Whiteboards were in most teaching rooms. A small number of additional computers were available in most classrooms. Some schools had supplemented their computer provision with laptops or were intending to do so in the near future. Where laptops were available, they were centrally located rather than allocated to pupils. No observations were made of pupils using their own or designated laptops in lessons.

Developments of e-learning strategies and increased technological provision were key features on the schools' improvement agendas. Plans to increase and improve technological opportunities for learning were intended to respond to pupils' preferences for using computer technology to undertake work and to raise standards. Increased provision of computer technology in support of the revised Key Stage 4 curriculum was considered by schools' senior managers to contribute to improved examination grades at the end of Year 11 and to support accelerated learning in Key Stage 3. At the time the study was conducted, learning technologies observed in classrooms were 'embedded in practice', 'developmental' or 'peripheral', as indicated in Table 3.1. 'Embedded in practice' refers to learning technologies that appear to be frequently provided and used by learners in lessons. 'Developmental' refers to learning technologies that schools are in the process of refining, extending and promoting as tools to support pupil learning. 'Peripheral' refers to learning technologies that were observed in pockets of practice and usually in particular subject areas.

Table 3.1: Embedded, developmental and peripheral learning technologies

Learning technology	Embedded	Developmental	Peripheral
Internet	*		
Interactive Whiteboard		*	
Virtual learning environment		*	
Games (revision)			*
Games: learning platform		*	
Email		*	
Videos			*
Mind maps			*
e-learning		*	

While Table 3.1 shows that the use of the internet is embedded in practice in the participating schools, this was mainly a feature of provision for Key Stage 4 pupils who appear to have wider access to computers than other pupils to support their course work for GCSE and BTEC national examinations. Restrictions were usually imposed on access to internet sites. The range and use of additional learning technologies in lessons appeared to be either developmental or peripheral, as described below.

Interactive Whiteboards are widely used as teaching tools by teachers, particularly in projecting PowerPoints of lesson aims and content and task outlines. However, their use as learning tools that engage pupils interactively with developing knowledge, concepts and ideas around subject content is at a developmental stage, with pockets of good practice observed in some lessons in some subjects in all the participating schools. Continuing professional development programmes in the schools aim to develop the potential of Interactive Whiteboard use as a learning tool more widely and consistently within and across subject areas. The schools participating in the study are developing their Virtual Learning Environments (VLEs) as interactive sites to provide increased facilities for meeting learners' needs in and out of school. The VLEs are currently mainly repositories for pupils' work and teachers' PowerPoints in some subjects, notably ICT.

The use of educational computer games for revision appears to be peripheral, occurring mainly in preparation for end-of Key Stage 3 national assessment tests and on occasion supported revision for examinations in Year 11. The games used were often from BBC BiteSize or similar educational sites. Observations of pupils using computer games for revision were observed in Mathematics, History, Science, ICT and French lessons.

The development of a games platform to support pupil engagement in learning in Key Stage 3 was being pursued in two of the participating schools, while another school used a games approach to deliver literacy intervention programmes to accelerate the catch-up of literacy skills for pupils requiring additional support in Year 7 and Year 8.

While examples of email correspondence between pupils and teachers to support pupil learning were found in two of the participating schools they were uncommon. Developments in the schools' VLEs are intended to promote more email exchanges in the service of pupil learning.

Videos and dynamic representations were incorporated in the use of Interactive Whiteboards in a few observed lessons in science. Videos and personal digital assistants (PDAs) for analysis of performance were not observed in lessons but were mentioned by some pupils in interviews. Their use as technologies supporting learning appeared to be peripheral in the sense of limited to particular subjects and courses such as PE or BTEC Sport.

The use of mind-mapping using the software Open Mind was used effectively to support learning by pupils in science lessons observed in one school. Use of voting pads was not observed but was mentioned in reference to one lesson in one school. In the present study the observed provision and use of technology acted as a social tool for learning on occasions, although it did not appear to support pupils in collaborative learning either offline or online.

Four of the participating schools were developing e-learning modules to support independent work. The e-learning materials were accessed by pupils through the School's server. Pupils who were interviewed considered that their e-learning was less than successful due to the lack of social interaction, opportunities for questions, and regular and timely feedback.

The use of mobile phones as learning devices was not in evidence in the participating schools. Of the pupils interviewed, the general view was that mobile phones are a social technology that should not be appropriated for educational use and that the advantages of using mobile phones for learning are minimal.

3.2 Pupil learning with technologies as cognitive tools, organising tools and social tools: an information-age mindset

Findings on Secondary school pupils' learning with technology are reported in reference to an information-age mindset identified in earlier research by Frand (2000). By presenting findings in this way, the report aims to provide deeper insights into the learning of the Millenial generation, and particularly in their use of learning technologies as cognitive tools, social tools, and organising tools for learning. The findings are therefore presented below under the following eight attributes of an information-age mindset identified by Frand (2000):

the computer is an assumed part of life and often not regarded as technology;

online affordances for interactivity and socialising are engaging;

reality is no longer real; that is, things may not be what they seem, may not be authentic or reliable, and may not be accurately sourced;

results and actions are considered more important than the accumulation of facts;

learning occurs more through trial and error approaches to problem solving than more logical or rule-based approaches to solving problems, and as such closely resembles games strategies;

there is zero tolerance for delays;

and distinctions between creator, owner and consumer are blurring.

i) The computer is an assumed part of life and often not regarded as technology

A possibly important observation in the present study was the difference in pupils' personal disposition and attitude towards learning tasks in lessons when provided with access to computer technology compared with learning contexts with no access to computer technology. When using computer technology in lessons, pupils appeared to be more comfortable, confident, relaxed, motivated and engaged as learners. Observations suggested that pupils were also more on task, more organised and less distracted. In this sense, access to the computer provided a 'natural' condition for learning and supported several positive features associated with learning. This observation was supported by pupils' comments, including the following:

> *'Everyone has their own style of learning, don't they? It suits each individual, and if they put it up on the computer everybody can understand it in their own way.'* (Gemma, Year 10)

In the following extract from an interview in a Personal, Social and Health Education lesson during an open-ended task on house purchasing, Sal indicates how the computer plays a central role in supporting her learning as a cognitive and organising tool:

> *I like computers. I love computers. It's easier. I can't really do maths that well. You can search stuff. When you are writing down sometimes you lose your books, but here it's better and faster. Spell check helps. (*Sal, Year 10)

The sense of a computer providing a 'natural' context for learning was expressed by Rob, a Year 10 pupil, who associates learning with computers as learning through decision-making:

> *It's more meaningful and more authentic being on the computer. It's easier to engage in. You're independent and making choices.*

The findings suggest that a main part of the 'natural' role that computer technology appears to play in the pupils' learning is that of a cognitive tool, as the following example in problem solving around conveyancing fees illustrates:

> *Well I searched for average conveyancing fees and I found this, because I went on 'conveyancing fees' and the average is , I think it is three-hundred and eighty four for a ninety thousand house, or four hundred and twenty for a hundred thousand house, so I was trying to work out what it would be for a hundred and seventy thousand pound house. So we would have to see what it would be. I just guessed the average like that. (*Paul, Year 10)

There is an expectation that computer technology, as an organising tool, will support personalised learning:

> *I think it's just the fact that we get to do it and work through it on our own and not with the class, so at our own pace. (*Phil, Year 10)

Similarly,

> *It makes you more individual. You are sitting with your work at the computer.*

The following comment emphasises the expectation Year 10 and Year 11 pupils have of access to computers and associated engagement in certain lessons:

> *You can walk straight into your classroom and they are already set up for you. You just need to log in. (*James, Year 10)

Overall interviews with pupils suggested an expectation of greater success in task completion and learning when using computer technology as cognitive and organising tools in lessons. This observation was also supported by the following comment by one of the teachers:

> *The links between the literacy and the learning- that word processing work just helps. I think the pupils find it relaxing. They get on the computer, they find it relaxing. A lot of pupils are quite daunted by science if they are not very confident, especially some of the girls. They are a lot more confident in that sort of setting than they are in a practical. (*Science teacher)

ii) Online affordances for interactivity

Findings from the present study suggest that the online affordance of interactivity transposes to lesson time spent online using the Interactive Whiteboard and educational computer games. Pupils' references to learning with educational computer games emphasise how games may operate as cognitive tools in engaging and enhancing thinking and in providing appropriate feedback, as represented in the following comments by John, a Year 9 pupil who was using games to revise for a Key Stage 3 science Standard Assessment Test (SAT):

> *It might have taken me longer to learn about measuring electricity in volts, because it puts you under a bit of pressure and you want to get a good score in the game, so you probably think more. It helps because if you get it wrong you know what the answer is and so you know its right because if you do it from a book there is nothing to tell you if you have got it right or wrong.* (John, Year 9)

However, the following comment from a Year 10 member of a school council reflects a certain cynicism about the use of games platforms for learning by the older pupils. In particular, appropriate levels of challenge are needed if online games are to effectively engage learning:

> *I think it helps if it's challenging, but most internet games are just so easy. They are not challenging enough to help you to learn.* (Mark, Year 10)

The theme of challenge for successfully engaging pupils in learning with online games was reinforced by Year 10 and Year 11 pupils in the interview with the school council (as above) in reference to their engagement in creative problem-solving scenarios in history lessons using computer simulations experience:

> *It was a history game, but more like questions, more choices. You create what you want it to be.* (Emma, Year 10)

In the example above, appropriate levels of challenge are associated with pupils' decision making and agency through manipulating subject content interactively in creative ways.

Similarly, the following reference to pupils' use of the Interactive Whiteboard in a science lesson indicates how pupils may feel engaged as learners through online interactivity and how their learning may be empowered:

> *Answering questions and filling in answers (on the Interactive Whiteboard) helps you to understand more. It makes you feel that you actually know something.* (Ellie, Year 10)

Benefits of the interactive affordances of computer technology as a social tool for learning were evident in pupils comments about their engagement in learning. For example, PowerPoint presentations by pupils to each other, based on their individual or group research, were valued by pupils as effective and efficient learning strategies:

> *In Science say we are revising plants and cells and metals, we will do a power point presentation and go up in groups and show all the key points on that topic…You are doing one yourself, but then you are learning all the key points from other presentations.* (James, Year 9)

The importance of interactivity in engaging pupils in learning is illustrated in the following extract from a conversation with a Year 10 pupil about what leads to effective learning in the context of online curriculum modules:

> *Having appropriate teaching when it is required and not when its not (is important). I'd say that it's more important that we learn from each other and learning from each others' mistakes, I think that is the best part. Social interaction.*
>
> *…The online curriculum is alright, but it's really it's just a resource, like a library. It would be better if it was more interactive.* (Joseph, Year 11)

The extract above highlights the need for appropriate levels of social interaction supporting learning to be built into online curriculum modules.

Interviews with pupils suggest that online interactivity operates as an organising tool for learning. Pupils consider it important that they can navigate around selected sites and choose which online content and activities to engage with. In this way, online interactivity is associated with personalised learning and pupil decision-making as the following extract indicates:

It leaves it to you to decide which bits you need to go on to improve on, or which bit you enjoy.. a little bit of guidance by giving us the science, but it is nice being able to go around the sites yourself. (Claire, Year 9)

iii) Reality is no longer real

This attribute considers that things may not be what they seem, may not be authentic or reliable, and may not be accurately sourced. It was therefore interesting to investigate how pupils use technology as a cognitive tool in this context.

Some pupils suggested that the accuracy and reliability of information from any source, including books and oral sources, could not be taken for granted:

I just think that the internet and books are the same as each other. You can't really choose. You just go for the easier option… There might be more information to rely on than teachers' answers. (George, Year 10)

Pupils employed strategies for judging the reliability of information, but information literacy or criticality was not applied consistently in information searches. Cognitive activity, promoted by the reality/unreality and reliable/unreliable nature of information accessed online, was identified around the pupils' strategies for judging reliability and managing information. Strategies included applying intuition and personal judgement, as in the following example:

Researcher: How are you sure whether this (information on the computer) is right?
Steven (Year 11): Because it sounds right.

Another strategy was recognising the potential generic unreliability of sources and to select sites that are deemed reliable and the least problematic:

I go on trusted websites. I'd say stick to stuff like Bitesize that you know is reliable. (Steven, Year 11).

A third strategy described by pupils was to 'Just accept it; take it as true' (Ella, Year 9). This strategy may indicate immature information literacy, but may also indicate a recognition that 'reality is no longer real' and that reality is difficult to isolate or capture.

A fourth strategy identified in pupils' interview responses was to use information obtained from internet sources to challenge understandings of reality and prior assumptions, as the extract below suggests:

I've been finding out how his disease (spinal muscular atrophy) wastes his muscles away and how he can deal with it, how he is dealing with it, his personal life and work, and his social life, how he uses his equipment to help him…if you see people like that you take a bit of pity on them, which isn't right. Here you think about how they get through life. That's what I have been thinking about really. (Jenny, Year 11).

The extract above suggests that computer technology used in this way acts as a cognitive tool to provoke new questions and consider new realities.

iv) Results and actions are considered more important than the accumulation of facts

This attribute refers to a preference for goal-oriented and process-led learning rather than increasing factual knowledge. This is illustrated in the example below where Emily, a Year 11 pupil revising for her history GCSE exam is predicting and preparing for exam questions using online revision sites:

It gives you a better understanding because when you are on the internet you have picture sources that support what the teacher said. If you are in an exam and you have seen an image you can think of it and in the exam it helps you. It helps you to remember texts that went along with it. It helps you to explain because you keep thinking what was happening in the pictures and you can write about that. (Emily, Year 11)

The example above indicates clearly how the technology operates as a cognitive tool to support Emily's learning in this instance.

In the following example a Year 8 pupil explains what he has learned using an Excel spreadsheet for planning a school gala. He emphasises the importance of creating a model or prototype:

> *How to create a model for the future when I need to calculate something and I need it more than once using EXCEL, do it that way. A model is basically something you can use over and over again like a formula that you can re-use.* (Ryan, Year 8)

Pupils' enthusiasm about the creation of mind-maps as learning tools using computer software exemplified this attribute of an information-age mindset for process-led learning, as the interview extracts below indicate. In the first example, a Year 9 pupil describes using Open Mind, a mind-mapping computer programme, for revising particles in solids, liquids and gases.

Researcher: How does this technology actually help you with your learning?
Luke: It is better than drawing it because it helps you to get more information in, and more pictures to help you remember what it says.
Researcher: How does it help you to sort your ideas out?
Luke: You can keep it and add as much information as you want on it.

Similarly, another Year 9 pupil emphasises the value of the mind-mapping programme as a cognitive process tool in the following interview extract:

Tracy: We are using Bitesize and then Printing on Open Mind as a mind map. We can include pictures and text.
Researcher: How is it helping you to learn?
Tracy: Because we know which branches to follow, so we can find the solid branch, and it tells you all the information.
Researcher: And that's information that you have put on?
Tracy: Yeah.
Researcher: So how is that better than if your teacher had put it all up for you?
Tracy: Because you know where they are, because you have done it yourself. If you put it on yourself then you know what you are struggling with, and it helps you like that. If the teacher puts it on it may be something you already know.
Researcher: So what have you found out today that you didn't know before, and that will help you when you come back to it next time?
Tracy: That solids are held together by strong forces called bonds.

In the following interview extract, Sarah's creation of a colour-coded mind map indicates the use of technology as a cognitive and organising tool for learning through customising the software:

Researcher: Tell me why you have colour coded them
Sarah: Well it's telling me what is more important and the green tells me what the blue means
Researcher: Have you made up that revision strategy yourself?
Sarah: Yes
Researcher: So explain how that works.
Sarah: Well it's a mind map and it branches out, and you put in what it means and what the word means…I've put 'The particles in gases are' and then I've put a branch and I've put 4 apart and another branch arranged in a random way.
Researcher: How is it helpful for learning?
Sarah: If you are using the colours it reminds you because it puts the colours in
Researcher: In a way that might be difficult without the computer?
Sarah: Yes

The examples above of learning with mind-mapping software suggests that the mind-mapping process and outcome is more important to the learners than accumulated facts.

The following extract from an interview with John, a Year 11 pupil referring to the use of computers as a communication tool in a science lesson, illustrates how the pupils respond positively to opportunities for using technology as a social and cognitive tool to share and accelerate their learning:

John: We use it in Science sometimes for presentations. I did it last time.
Researcher: How did that go?
John: Fine. I did it on the big screen. I got a merit for it.
Researcher: What was the subject matter you were talking about?
John: We had to do all different subjects. We had wind turbines, others had wave generation, so we learned about it all together.
Researcher: Did you find that helped you to learn more about it?
John: Yeah
Researcher: Did it help you to learn when you were putting the presentation together or did it help you to learn when you did the presentation?
John: When you had to make a table about everyone else's stuff, it's like quick learning.

The emphasis on results and actions in the extract above is also reflected in the following comment about the use of Interactive Whiteboards as teaching tools:

Whiteboards do help, but it is the teacher doing it not us, so I prefer doing it on the computer so we do it ourselves and learn more. (Craig, Year 9)

This comment, while brief, importantly highlights the pupil's preference for active engagement in the learning process using the computer technology as a cognitive tool, and a sense that more meaningful learning is achieved in this way. This is also illustrated in the following extract that indicates how Ellie, a Year 10 pupil researching public limited companies in a business studies lesson, learned incidentally by following her own online enquiry:

I'm doing public limited company services, and looking at the FTSE where the stock market has just exchanged, from the finance site. I have not used it before. It takes one hundred companies and that's how they have been trading. It has just started going down. Since ten o'clock it has just been going on a down. I am going to look for some companies now. I have learned what is happening to the stock market today. (Ellie, Year 10)

v) Learning occurs more through trial and error approaches to problem solving than more logical or rule-based approaches to solving problems, and as such closely resembles games strategies

Using the computer as a cognitive tool in a trial and error approach to learning is in pupils' internet searches, as the following interview extract illustrates:

Researcher: Which searches were the best ones? You are looking at spinal muscular atrophy Type 2. Is it easy to find what you want?
Will: No because there's all different kinds of stuff you are looking for.
Researcher: How have you decided which is the best site to go on?
Will: I don't know, I'm just searching all different ones.
(Interval)
Researcher: So have you found one you are going to use?
Will: No not yet.
(Interval)
Will: Ah, here's one (a fact sheet, which was deemed to provide the most useful information)

Interviews and classroom observations suggested that the feature of trial and error learning supported by rapid feedback, characteristic of some educational computer games, appeals to learners and engages them cognitively:

I don't know this one, so I am going to guess. Wrong. So I know it's limestone. (Joe, Year 9)

The importance of rapid feedback in supporting trial and error learning was expressed by Tom, a Year 8 pupil:

> *It's important because if it takes you ages and ages you might remember it but you are not going to be going forward as quick as you want to be* (Tom, Year 8)

In the following extract, Emma, a Year 9 pupil, talks about the value of computer games for mathematical learning. Here Emma indicates the importance of appropriate levels of challenge for trial and error learning with technology to be effective:

> *My Maths, it's different. Countdown. It explains it, like algebra. You can choose the questions and the level, so you can choose easy or hard. It will tell you what you need to revise and where to go and what to do to improve.* (Emma, Year 9).

In the example above, the computer technology and software are used as organising tools to support Emma's learning.

vi) Staying connected is essential

Frand (2000) suggests that the use of mobile phones, computers and personal digital assistants (PDAs) ensure that millenials stay in touch and remain connected. Frand (ibid) observes that increasing numbers of pupils participate in real time dialogues from anywhere using a variety of devices. The present study was therefore interested to investigate how 'staying connected' featured in learning pupils in the participating Secondary schools. The study took a broad view of 'staying in touch and remaining 'connected', which included connecting to the world wide web, connecting with oneself via emailing work; connecting with teachers via email; connecting to the institution's Virtual Learning Environment (VLE) and connecting with friends in learning related contexts.

While the simultaneous use of multiple sites is a recognised characteristic of the millennial generation's engagement with technology for learning, the study provided evidence of pupils managing and representing information and connectedness to multiple sites in creative ways. For example, in building a web page about a funfair, Gareth, a Year 10 pupil, simultaneously accessed Microsoft Publisher, Google, Google images, a template for a publisher document, and the OpenMind software programme. Gareth found images to place on the mind-mapping branches to represent the textual information he had found, and was able to keep a permanent record for reference and updating on the School's server. The technology was therefore used as a cognitive and an organising tool to support Gareth's learning in this example of curriculum connectedness.

Pupils talked about sending files to each other on MSN to support school work, emailing course work to themselves, emailing work to teachers, emailing teachers to ask questions, using the shared area on the school's Virtual Learning Environment (VLE) to organise and save work in electronic folders, and to access learning material. In these contexts of staying in touch and keeping connected, the technology acted as a social and organising tool for learning, as the following extracts show:

> *The best thing about it is that teachers can put their PowerPoints onto the shared area…That's why in Maths it's a good idea, because when our teachers put the lesson notes on PowerPoint and puts them on the shared area, you can see them. It's useful to revise from, or if you thought you missed something from the lesson.*
> (Lisa, Year 10)

And similarly:

> *It's easy to find things on the shared area. It helps to organise own work in own folders. (*Claire, Year 9)

There was some limited evidence of pupils staying in touch and keeping connected using personal digital assistants (PDAs) as organising tools for learning:

> *I did my biology coursework and my PE coursework on my PDA while I was going on holiday, so I'd say there was potential, but it would cost a lot of money. (*Steven, Year 11)

Similarly:

> *PDAs would be a lot better for keeping track of your time-table. You would be a lot less likely to lose a personal organiser than a planner. (*Mark, Year 10)

Pupils referred to using MSN as a support platform for school work:

*Like last night I was doing coursework and I was getting a couple of friends to send me examples. We send files to each other on MSN, it's direct. (*Mike, Year 11.)

In the schools and colleges participating in the study mobile phones were not used as devices to support connectedness for learning.

vii) There is zero tolerance for delays

As pupils talked about the use of technology for learning, they suggested that engagement in learning is partly determined by immediate access to the technology. In addition, immediate access was associated with positive attitudes to learning, a learner identity, empowerment through choice and decision-making, and the ability to organise and manage personal learning. A Year 11 pupil, for example, talked about the speed of online searches releasing more lesson time for the harder work of using that information in the task:

Because you can find the information quicker, if you can get the precise information you need using modern technology, then you are ready to carry on with your work after about fifteen minutes of research. (Dave, Year 11)

In contrast, delays and constraints associated with the technology appear to lead regularly to serious frustrations about learning:

*The computers are really slow. It takes so long to log on you often can't get anything done. Laptops are really slow and fiddly. Teachers think using laptops are really fun for you, but they are not, because by the time you have got onto it you have got half an hour to do your work. They are a bit pointless because you can't really use them. Teachers fret that you might break something. (*Reid, Year 11)

The following comment suggests a feeling of 'powering down' with technology in classrooms:

I would suggest to the teachers to modify this. An upgrade to 2007 version would be quicker and better. (Jake, Year 9)

Similarly, restricted search opportunities are seen as obstructions to meaningful learning:

*Most of the internet websites that you need are blocked and you can't get on to it, so it's like, "Oh, what shall we do?" (*Kerry, Year 10)

In the next example, Suzie describes how restricted access to computers has led to a disinterest in the use of the library:

I used to go in the library but I don't anymore really, I have kind of lost interest.

*Access to computers in the library is difficult. Mobile technologies would take the pressure off having to book machines. (*Suzie, Year 10)

viii) Distinctions between creator, owner and consumer are blurring

Generally pupils considered that the computer provided easy access to other sources, ideas, illustrations, and resources that could be put into their work:

*I'm getting some help from Detachta website for careers, and also from Havens' website on how they have designed their website to make it user efficient so it is going into my design box. (*Andrew, Year 11)

Some pupils, understood the concept of plagiarism, were aware that it takes place and expressed some concerns about it, as the following extract from a group interview suggests:

Dave: A lot of plagiarism goes on, copying, cut and paste. Is there a new technology that stops plagiarism, that finds it?

Alex: Some sites have banned right clicking so you can't copy.

Appropriation of information and ideas and instances of plagiarism therefore appear to blur distinctions between the creator and owner of ideas and knowledge and the consumer who uses them in different contexts.

It is important to note, however, that pupils are encouraged to use cognitive strategies to avoid plagiarism and simple appropriation of information. Pupils demonstrated development in information literacy through describing, explaining and evaluating ideas and information

obtained online. Where these cognitive processes were applied in pupils' engagement with technology, the information was transformed and learning was enhanced. This is illustrated in the following example:

> *We use it in our course work. You have to describe what you are saying, you explain it, and then you evaluate it for how it effects you. In English you use P (point) E (explain) E (evidence), so you make your point, you explain it, and then you give some evidence for it.* (Lauren, Year 11)
>
> *If you do that then you are on a grade B or above for everything. If you get used to doing that then you are well on your way to getting a good GCSE result. (*Dave, Year 11)

The extracts above suggest pupils' awareness that effective learning involves a personal engagement with the information that transforms it and gives personal ownership.

3.3 Findings from the pupil survey: informing our understanding of learning with technology in the Secondary school sector.

Surveys were completed by 469 Secondary school pupils across the year groups as shown in Table 3.2. (also see Appendix 1).

Table 3.2 The year profile of pupils who completed the survey

Year group	Percentage of surveys completed by year groups
7	4.7
8	14.9
9	34.8
10	20.7
11	23.2
6.1	0.6
6.2	1.1

Completion of the survey was 48.8% by male pupils and 52.2% by female pupils.
In response to the question 'Do you like using technology in your schoolwork?' 82.6 percent responded yes, 3.5 percent responded no, and 13.9 percent were unsure.
The findings from the survey were as follows:
In response to questions about the use of technology to support learning in school, 89.4% pupils reported that they use computers often or very often to learn in school;
11.2% pupils reported that they use a laptop often or very often to learn in school;
61.8% pupils reported that they learn often or very often with an Interactive Whiteboard in school, although 12.9% of pupils indicated that they did not at all and 25.3% indicated not often;
17.2% pupils reported that they use digital cameras often or very often to support their learning.

In response to questions about how technology supports their learning in school,
84.4% pupils reported that technology often or very often helps them to find things out:
61.7% pupils reported that technology often or very often helps them to solve problems;
53.9% pupils reported that technology often or very often helps them to sort out their ideas;
86.9% pupils reported that technology often or very often helps them to make their work better;
37.5% pupils reported that technology often or very often helps them to be critical;71.1% pupils reported that technology often or very often helps them to revise;
39.6% pupils reported that technology often or very often helps them to talk to friends about school work.
The findings presented above suggest that pupils consider technology to be a cognitive tool and an organising tool for learning. While the main functions of technology are linked to

accessing information and improving pupils' work, presumably through correcting and redrafting, technology is also associated, but to a lesser degree, with conceptual development and critical thinking.

In response to questions about engagement in learning with technology:

59.9% pupils reported being quite a lot or very enthusiastic about learning with technology at school, with13.5% saying that they were very enthusiastic.

65.5% reported that using technology makes them more interested in learning, 6.3% reported that using technology does not make them more interested in learning, and 18.1% were unsure.

41% indicated that using technology made them more interested in homework, while 36.5% reported that they use the internet often or very often to learn at home, while 11.1% reported not using the internet at all to support their learning at home.

The set of findings above suggest that pupils may be less enthusiastic about learning with technology in school than might be expected. It is interesting to speculate reasons for this, which may be associated with access difficulties or the nature of the tasks. The findings might also reflect a sense of 'powering down' when pupils use the technology available in schools.

3.4 Examples of good practice in using technology to support pupil engagement in learning

In this section, judgements about good practice in using technology to support pupil engagement in learning are informed by the work of Pianta et al (2006) who identified features of teaching for pupil engagement in Secondary school classrooms. In this study, the criteria developed by Pianta et al (ibid) have been adopted and applied to contexts of learning with technology informed by Becta (2007). In particular, 'indicators of student engagement' have been identified as an analytical tool. The indicators refer to forms of student engagement in learning associated with the use of learning technology. The term suggests cognitive, social, emotional and organisational aspects of the learner's engagement. Indicators may include volunteering information/participating in discussion with enthusiasm; expressing curiosity/excitement; actively and purposefully manipulating materials; relating ideas; using evidence/citing examples/referring to text; reflecting on meaning; and responding creatively or critically.

The resulting framework, which indicates the theoretical relationship between pedagogy for engagement and student engagement in learning, and which informs the observations reported in this section, is presented below in Table 3.3.

Table 3.3: Framework for identifying good practice in using technology to support pupil engagement in learning

Focus for pupil engagement	Pedagogical approaches for engagement in learning	Indicators of pupil engagement in learning with technology
Instructional learning	Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness, exploration, inquiry, and manipulation of and interaction with content	Manipulates and explores learning materials; Volunteers information; Participates in discussions
Content understanding	The teaching focus is primarily on meaningful understanding of big ideas and concepts (broad framework and key ideas) through a variety of rich and appropriate positive examples and contrasting non-examples; Teaching explicitly links new concepts and big ideas to students' background knowledge; Teaching effectively makes use of different perspectives; Teaching demonstrates/presents deep subject knowledge and expertise	Analyses and reflects on features and characteristics of concepts; Links and incorporates new material to background knowledge; Relates learning to other new ideas or contexts in rich discussion; Understands different perspectives and justifies/substantiates the position taken; Applies thinking to real world events and situations; Asks quality questions and raise issues
Analysis and problem solving	Teaching emphasises analysis, integration, and application of knowledge and skills through problem solving, reasoning, and experimentation; Teaching provides opportunities for meta-cognition Teaching promotes experimentation, and the generation of ideas; Teaching regularly models opportunities for meta-cognition; Teaching promotes cognitive epistemic activity: describing, explaining, explicating, arguing, predicting, defining, evaluating	Solves or reasons through open-ended tasks, independently or as part of a group; Selects, uses or applies existing knowledge or skills; Makes choices (content, procedural) about how to find out or solve problems; Makes inferences; Thinks critically; Responds creativity; Reflects on and shares developing thought processes (thinking about thinking)
Quality of feedback	Provision of feedback focussed on expanding or extending learning	Shows a deeper understanding of material and concepts; Focuses attention on the process of learning; Engages in discussion about work that promotes further learning

Using these criteria in Table 3.3, adapted from Pianta et al (2006) and Becta (2007), effective pedagogic approaches to student engagement in learning using learning technologies were identified in the data.

Examples of observed good practice in using technology to support pupil engagement in learning are reported below, in reference to Table 3.3. and Table 3.1, which identified pupils' use of embedded, developmental and peripheral learning technologies earlier in this section. A profile is given of pedagogical approaches for engagement and of indicators of student engagement with technology for an example of each type of learning technology identified in Table 3.1. Examples of pupils' use of technology as a learning tool feature the following: the Internet, Interactive Whiteboards, schools' Virtual Learning Environments (VLE),

educational computer games, email, computer-based mind-mapping, videos, and e-learning materials.

3.4.1 Pupils' use of the Internet for learning

Table 3.4 identifies pedagogical approaches for engagement and indicators of pupil engagement in a lesson in which a Year 10 class were researching, 'how a person with spinal muscular atrophy might use technology in personal, social and work contexts'. The pupils reported their findings through describing, explaining and evaluating.

Table 3.4: Pedagogical approaches and indicators of pupil engagement in learning: Pupils' use of the Internet for learning

Pedagogical approaches for engagement	Indicators of pupil engagement in learning with technology
Instructional learning: Using a variety of media; Providing interesting materials that promote awareness, exploration, inquiry, and manipulation of and interaction with content	Manipulates and explores learning materials; Participates in discussions
Content understanding: The teaching focus is primarily on meaningful understanding of big ideas and concepts (broad framework and key ideas) through a variety of rich and appropriate positive examples; Teaching explicitly links new concepts and big ideas to students' background knowledge; Teaching effectively makes use of different perspectives; Teaching demonstrates/presents deep subject knowledge and expertise	Analyses and reflects on features and characteristics of concepts; Links and incorporates new material to background knowledge; Relates learning to other new ideas or contexts in rich discussion; Applies thinking to real world events and situations
Analysis and problem solving: Teaching promotes cognitive epistemic activity: describing, explaining, explicating, arguing, predicting, defining, evaluating	Solves or reasons through open-ended tasks, independently or as part of a group; Selects, uses or applies existing knowledge or skills; Makes choices (content, procedural) about how to find out or solve problems; Makes inferences; Thinks critically; Reflects on and shares developing thought processes (thinking about thinking)

In addition to the example presented above, examples of good practice in using the Internet to support pupil engagement in learning were observed in lessons in the following subjects: Art; business studies; history; personal, social, and health education; and ICT.

3.4.2 Pupils' use of the Interactive Whiteboard for learning

Table 3.5 identifies pedagogical approaches for engagement and indicators of pupil engagement in a Year 10 science lesson on food additives, allergies and diabetes. The pupils highlighted the names and number of additives identified on food packaging, using the Interactive Whiteboard, and discussed their effects. In reference to dynamic representation, pupils explain how the blood sugar level rises and falls, and how the liver functions after eating. Following the principles illustrated by the teacher creating a diagrammatic representation the liver function on the Interactive Whiteboard, pupils created their own representations.

Table 3.5: Pedagogical approaches and indicators of pupil engagement in learning: Pupils' use of the Interactive Whiteboard for learning

Pedagogical approaches for engagement	Indicators of pupil engagement in learning with technology
Instructional learning: Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness, exploration, inquiry, and manipulation of and interaction with content	Manipulates and explores learning materials; Volunteers information; Participates in discussions
Content understanding: The teaching focus is primarily on meaningful understanding of big ideas and concepts (broad framework and key ideas) through a variety of rich and appropriate positive examples and contrasting non-examples; Teaching explicitly links new concepts and big ideas to students' background knowledge; Teaching effectively makes use of different perspectives; Teaching demonstrates/presents deep subject knowledge and expertise	Analyses and reflects on features and characteristics of concepts; Links and incorporates new material to background knowledge; Relates learning to other new ideas or contexts in rich discussion; Understands different perspectives and justifies/substantiates the position taken; Applies thinking to real world events and situations; Asks quality questions and raise issues
Analysis and problem solving: Teaching emphasises analysis, integration, and application of knowledge and skills through reasoning; Teaching promotes cognitive epistemic activity: describing, explaining, explicating, arguing, predicting, defining, evaluating	Reasons through open-ended tasks independently and as part of a group; Selects, uses and applies existing knowledge or skills; Makes inferences; Thinks critically
Quality of feedback: Provision of feedback focussed on expanding or extending learning	Shows a deeper understanding of material and concepts

In addition to the example presented above, examples of good practice in using Interactive Whiteboards to support pupil engagement in learning were observed in other lessons in the following subjects: Science, English, French, and Spanish.

3.4.3 Pupils' use of the Virtual Learning Environment (VLE) for learning

Table 3.6 identifies pedagogical approaches for engagement and indicators of pupil engagement in a Year 10 lesson in technology. Pupils used the school intranet to access online curriculum materials for designing board games for an early years child, including explication of colour theory, exemplification of standards and requirements for assessment grades; exemplary work from previous years; and design tools.

Table 3.6: Pedagogical approaches and indicators of pupil engagement in learning: Pupils' use of the Virtual Learning Environment (VLE) for learning

Pedagogical approaches for engagement	Indicators of pupil engagement in learning with technology
Instructional learning: Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness, exploration, inquiry, and manipulation of and interaction with content	Manipulates and explores learning materials; Participates in discussions
Content understanding: The teaching focus is primarily on meaningful understanding of big ideas and concepts (broad framework and key ideas) through a variety of rich and appropriate positive examples and contrasting non-examples;	Analyses and reflects on features and characteristics of concepts; Links and incorporates new material to background knowledge; Relates learning to other new ideas or contexts in rich discussion;

Teaching explicitly links new concepts and big ideas to students' background knowledge; Teaching effectively makes use of different perspectives; Teaching demonstrates/presents deep subject knowledge and expertise	Understands different perspectives and justifies/substantiates the position taken; Applies thinking to real world events and situations;
Analysis and problem solving: Teaching emphasises analysis, integration, and application of knowledge and skills through problem solving, reasoning, and experimentation; Teaching provides opportunities for meta-cognition Teaching promotes experimentation, and the generation of ideas; Teaching regularly models opportunities for meta-cognition; Teaching promotes cognitive epistemic activity: describing, explaining, explicating, arguing, predicting, defining, evaluating	Solves or reasons through open-ended tasks independently ; Selects, uses or applies existing knowledge or skills; Makes choices (content, procedural) about how to find out or solve problems; Makes inferences; Thinks critically; Responds creativity; Reflects on and share developing thought processes (thinking about thinking)
Quality of feedback: Provision of feedback focussed on expanding or extending learning	Shows a deeper understanding of material and concepts; Engages in discussion about work that promotes further learning

In addition to the example presented above, examples of good practice in using virtual learning environments to support pupil engagement in learning were observed in lessons in ICT, French and German.

3.4.4 Pupils' use of educational computer games for learning

Table 3.7 identifies pedagogical approaches for engagement and indicators of pupil engagement in a Year 11 French lesson in vocabulary revision and extension. Pupils played an 'against the clock' vocabulary game using the Interactive Whiteboard for positive and negative personality traits.

Table 3.7: Pedagogical approaches and indicators of pupil engagement in learning: Pupils' use of educational computer games for learning

Pedagogical approaches for engagement	Indicators of pupil engagement in learning with technology
Instructional learning: Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness and manipulation of and interaction with content	Manipulates and explores learning materials; Volunteers information; Participates in discussions
Content understanding: Teaching demonstrates/presents deep subject knowledge and expertise	Links and incorporates new material to background knowledge
Analysis and problem solving: Teaching promotes cognitive epistemic activity: describing, explaining	Selects and applies existing knowledge or skills
Quality of feedback: Provision of feedback focussed on expanding or extending learning	Shows a deeper understanding of material and concepts; Engages in discussion about work that promotes further learning

In addition to the example presented above, examples of good practice in using computer games technology to support pupil engagement in learning were observed in other lessons in Maths, French, Spanish and English.

3.4.5 Pupils' use of e-mail for learning

Table 3.8 identifies pedagogical approaches for engagement and indicators of pupil engagement in a Year 6.2 (Upper Sixth) ICT lesson on creating a web page for a club: E-mail received from tutor suggesting a supported search on the Internet to identify ways that clubs attract custom, and requiring a prompt response with the required information.

Table 3.8: Pedagogical approaches and indicators of pupil engagement in learning: Pupils' use of email for learning

Pedagogical approaches for engagement	Indicators of pupil engagement in learning with technology
Instructional learning: Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness, exploration, inquiry, and manipulation of and interaction with content	Manipulates and explores learning materials
Content understanding: The teaching focus is primarily on meaningful understanding of big ideas and concepts (broad framework and key ideas) through a variety of rich and appropriate positive examples; Teaching explicitly links new concepts and big ideas to students' background knowledge;	Analyses and reflects on features and characteristics of concepts; Links and incorporates new material to background knowledge
Analysis and problem solving: Teaching promotes cognitive epistemic activity: describing, explaining, evaluating	Solves or reasons through open-ended tasks, independently; Selects and applies existing knowledge or skills; Makes inferences; Thinks critically; Responds creativity
Quality of feedback: Provision of feedback focussed on expanding or extending learning	Shows a deeper understanding of material and concepts; Focuses attention on the process of learning; Engages in discussion about work that promotes further learning

In addition to the example presented above, examples of good practice in using e-mail to support pupil engagement in learning were observed in lessons in ICT and Science.

3.4.6 Pupils' use of computer-based mind-maps for learning

Table 3.9 identifies pedagogical approaches for engagement and indicators of pupil engagement in a Year 9 Science revision lesson on properties of particles I solids, liquids and gases using BBC Bitesize and Open Mind, a computer concept-mapping programme.

Table 3.9: Pedagogical approaches and indicators of pupil engagement in learning: Pupils' use of computer-based mind-maps for learning

Pedagogical approaches for engagement	Indicators of pupil engagement in learning with technology
Instructional learning: Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness, exploration, inquiry, and manipulation of and interaction with content	Manipulates and explores learning materials; Volunteers information; Participates in discussions
Content understanding: The teaching focus is primarily on meaningful understanding of big ideas and concepts (broad framework and key ideas) through a variety of rich and appropriate positive; Teaching explicitly links new concepts and big ideas to students' background knowledge; Teaching demonstrates/presents deep subject knowledge and expertise	Analyses and reflects on features and characteristics of concepts; Links and incorporates new material to background knowledge
Analysis and problem solving: Teaching emphasises analysis, integration, and application of knowledge and skills through problem solving and reasoning; Teaching regularly models opportunities for meta-cognition; Teaching promotes cognitive epistemic activity: describing, explaining, defining	Solves or reasons through open-ended tasks independently; Selects and applies existing knowledge or skills; Makes choices (content, procedural) about how to find out or solve problems; Responds creativity; Reflects on and shares developing thought processes (thinking about thinking)
Quality of feedback: Provision of feedback focussed on expanding or extending learning	Shows a deeper understanding of material and concepts

In addition to the example presented above, examples of good practice in using computer software for mind-mapping to support pupil engagement in learning were observed in ICT lessons.

3.4.7 Pupils' use of videos for learning

Table 3.10 identifies pedagogical approaches for engagement and indicators of pupil engagement in a Year 7 science lesson on life-cycles, using a video clip of a water turtle. After watching the video clip, pupils generated their own questions about the life cycle of the water turtle. After a second viewing of the video, pupils were able to answer most of their questions, and to speculate on others.

Table 3.10: Pedagogical approaches and indicators of pupil engagement in learning: Pupils' use of videos for learning

Focus of pupil engagement	Pedagogical approaches for engagement	Indicators of pupil engagement in learning with technology
Instructional learning	Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness, exploration, inquiry, and manipulation of and interaction with content	Explores learning materials; Volunteers information; Participates in discussions

Content understanding	The teaching focus is primarily on meaningful understanding of big ideas and concepts (broad framework and key ideas) through a variety of rich and appropriate positive examples and contrasting non-examples; Teaching explicitly links new concepts and big ideas to students' background knowledge; Teaching effectively makes use of different perspectives; Teaching demonstrates/presents deep subject knowledge and expertise	Analyses and reflects on features and characteristics of concepts; Links and incorporates new material to background knowledge; Relates learning to other new ideas or contexts in rich discussion; Applies thinking to real world events and situations; Asks quality questions and raises issues
Analysis and problem solving	Teaching emphasises analysis, integration, and application of knowledge and skills through reasoning; Teaching provides opportunities for meta-cognition; Teaching promotes the generation of ideas; Teaching promotes cognitive epistemic activity: describing, explaining, arguing, predicting.	Solves or reasons through open-ended tasks, independently and as part of a group; Selects, uses and applies existing knowledge or skills; Makes inferences; Reflects on and shares developing thought processes (thinking about thinking)
Quality of feedback	Provision of feedback focussed on expanding or extending learning	Shows a deeper understanding of material and concepts; Focuses attention on the process of learning; Engages in discussion about work that promotes further learning

3.4.8 Pupils' use of e-learning

Table 3.11 identifies pedagogical approaches for engagement and indicators of pupil engagement in a Year 9 lesson in German. Independent study was undertaken using an e-learning programme for German speaking and listening accessed through the school server.

Table 3.11: Pedagogical approaches and indicators of pupil engagement in learning: Pupils' use of e-learning

Pedagogical approaches for engagement	Indicators of pupil engagement in learning with technology
Instructional learning: Presenting information through multiple modalities and using multiple strategies and techniques; Using a variety of media; Providing interesting materials that promote awareness, and interaction with content	Explores learning materials
Content understanding: Teaching explicitly links new concepts and big ideas to students' background knowledge; Teaching demonstrates/presents deep subject knowledge and expertise	Links and incorporates new material to background knowledge
Analysis and problem solving: Teaching emphasises analysis, integration, and application of knowledge and skills through reasoning, and experimentation; Teaching promotes cognitive epistemic activity: describing and evaluating	Solves or reasons through open-ended tasks independently; Selects and applies existing knowledge or skills
Quality of feedback: Limited feedback provided	Limited opportunity to respond to feedback

In addition to the example presented above, examples of good practice in using e-learning to support pupil engagement in learning were observed in lessons in Design and Technology, French, and Business Studies

3.5 Conclusions

The overview of technology supporting pupil learning in the participating schools, in embedded, developmental and peripheral ways, supports recent findings from the Harnessing Technology schools survey, commissioned by Becta (2007), that the diversity of application of ICT resources in classrooms is limited. The survey reported that ICT is mostly used for whole class activities, interpreted as a possible reference to the use of Interactive Whiteboards, and for 'traditional purposes such as information gathering' (Becta, 2007). However, findings from the present study suggest a development in the range of learning technologies used by pupils. While variability in the use of technology for learning was found between schools and subjects, the evidence suggests that pupils engage with learning through using technologies as cognitive and organising tools. Learning technologies appear to be used less as social tools for learning. These findings may further our understanding of how pupils learn with technology (Conole et al, 2007).

Mind-set characteristics of information-age learners (Frand, 2000) provided a useful interpretive frame for considering pupils' learning with technology in Secondary school classrooms. In particular, pupils' learning preferences of autonomy, personalised learning, interactivity, exploratory learning through trial-and-error, creativity, appropriation, and customisation were apparent in pupils' interview data. Negative characteristics were associated with the concept of 'powering down' and with the related theme of restricted or problematic access.

Findings from the present study suggest that 'powering down' occurs in some instances in Secondary school classrooms. 'Powering down' refers to pupils' feelings of disengagement in learning because their preferred technologies and the technological skills they have acquired are not provided for in current teaching and learning methods in schools (Puttnam, 2007). Findings suggest that 'powering down' is associated with the following: inequality of access or restricted access to computer technology; limited quality, capacity and power of the technology provided; access difficulties; restrictions imposed on the use of the technology and teacher anxiety about pupils breaking technological devices. 'Empowering learning' would be the opposite of 'powering down', where technologies that pupils use effectively outside the classroom are used to enhance learning in the curriculum.

Considering the findings presented above, it may be concluded that pupils' learning preferences and inhibitors identified in the present study may usefully extend and update those identified earlier by Frand (2000).

Results of the pupil survey suggest that pupils consider technology to be a cognitive tool and an organising tool for learning and associate its use with accessing information and improving work, but also, to a lesser degree, with conceptual development and critical thinking. This finding indicates an expectation some pupils have about the use of technology to support learning. To some extent, this finding challenges teachers' views, reported in the Becta Harnessing Technology schools survey (2007), that the use of ICT in the classroom impacts more on pupil motivation and engagement than achievement. The finding in the survey in this study, that pupils may be less enthusiastic about learning with technology in school than might be expected, raises questions about the relationships between technological provision, appropriateness of tasks and learner preferences and technological skills.

Ways in which pedagogical approaches for engagement underpin pupil engagement in learning with technology are illustrated by examples of good practice in using technology to support pupil engagement in learning. The analysis of examples indicate that the framework adapted from Pianta et al (2006), and informed by Becta (2007), may provide a useful set of criteria to inform and evaluate effective teaching with technology. Similarly, the analysis may help to recognise, capture, and evaluate instances of pupil learning with technology. Pupil

learning with technology may be represented as a relationship between pedagogy for engagement, indicators of pupil engagement, and the learning technology pupils use, as illustrated in Figure 3.1.

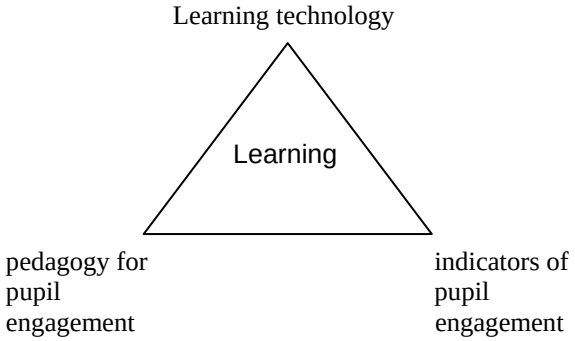


Figure 3.1: Interrelating factors influencing pupil learning with technology: a representation

It is perhaps particularly interesting to note where, in the examples presented above at least, pedagogy for engagement and indicators of pupil engagement are particularly high in some developmental and peripheral uses of technology for learning, notably in the examples of using the institution's VLE, Interactive Whiteboards, computer-based mind-mapping, and using video to stimulate questions.

3.6 Recommendations

The following recommendations for transitional pedagogy, or teaching approaches for engaging pupils learning with technology that are developed within and across educational sectors from Secondary schools to HE, may be drawn from the findings reported in this section of the report:

Maximise the range of pedagogical approaches for engaging pupils /students in learning with technology;

Recognise, capture, evaluate and make explicit instances of pupil/student engagement in learning with technology;

Recognise and support the dissemination of good practice in the provision for pupils/students to learn with embedded, developmental and peripheral learning technologies;

Maximise opportunities for empowering learning with technology as opposed to 'powering down';

Seek to develop the use of technology as a cognitive, organising and social tool in support of learning;

Increase opportunities for technology to be a social tool for learning;

Recognise pupils'/students' learning preferences, their learning mind-set, and how they operate as learners. In particular, explore ways to best support learning with technology in reference to preferences for autonomy, personalised learning, interactivity, exploratory learning through trial –and-error, creativity, appropriation and customisation;

Consider how a focus on cognitive activities such as describing, explaining, evaluating and arguing may support meaningful interaction with and transformation of information and reduce plagiarism.

4 Pedagogy underpinning Secondary school pupils' engagement in school-based learning with technology

This section reports findings from interviews with teachers in the participating schools on their pedagogical assumptions underpinning teaching and learning with technology.

In the extract below a teacher expresses the important role technology plays in the everyday lives of the majority of pupils. In emphasising the need to acknowledge and integrate pupils' learning with technologies out of school into the pupils' experience of learning in school, the pedagogical challenge for engaging the new generation of digital learners is identified:

> *Ninety per cent of the kids have computers at home, they use them every single day, they are on the Internet, on different websites, the use Xboxes, they are all linking. They play people from different countries on different games, they all know the lingo and they are picking it up. It is all developing so quickly. We need to keep up to that in schools to make sure that we are entertaining them and educating them in that sort of way.* (Mike, PE teacher)

The study sought to identify the pedagogical principles currently underpinning the use of learning technology in Secondary schools. This section reports the findings from semi-structured interviews with twenty teachers in the six schools and colleges in the Secondary school sector who participated in the project. The interviews focussed on the teachers' pedagogical assumptions and beliefs underpinning how they used technology in their lessons to support pupils' learning.

Themes that emerged from the teachers' interview responses indicated a range of pedagogical principles underpinning the use of learning technology to support pupils' engagement in learning across the curriculum. The themes were the role of computer games and social technologies in learning; increasing pupil engagement in learning to raise standards; using technology as a cognitive tool; promoting personalised learning; using technology as an organising tool for learning; and increasing opportunities for interactive social learning. Each theme is exemplified and discussed below.

4.1 The role of computer games and social technologies

Using recognised Internet sites for playing games was a revision strategy for a range of subjects. In the extract below from an interview with a history teacher an emphasis was placed on pupil enjoyment and reinforcement of learning:

> *There are lots of websites that we can use. School History is a common one that we can use and on School History there are learning games …The pupils enjoy it. It is something different to do, and although they are playing games they are learning at the same time. It is reinforcing the learning that has taken place.* (David, History teacher)

A similar emphasis is placed on reinforcement in the following extract, which also raises the role of challenge in learning with games:

> *They are preparing for their assessment, so they've got speaking test questions that they are preparing and they are going onto a platform that is all games that they are using for revising. It's a very exciting way, particularly for reinforcing their vocabulary. They particularly like a challenge so that is why they are doing it. It's very interactive and very thoughtful as well.* (Kerry, French teacher)

The advantages of mobile phones and podcasts were identified in modern foreign languages for developing speaking and listening skills:

> *Recordings (on mobile phones) are very useful for speaking practice, listening to something rather than reading it we find that their accent improves. It's very useful in that respect…I did some research and found lots of podcast addresses that are down-loadable from ITunes and we are going to hand that out because they were useful.* (Kerry, French teacher)

With the exception of modern foreign languages, schools participating in the project were reluctant to introduce mobile social technologies into classrooms. Potential disruptions to learning were considered to outweigh pedagogically effective ways of using mobile technologies to support learning.

4.2 Widening participation and improving assessment practices and outcomes.

Teachers' use of learning technologies was closely linked to the widening participation agenda and to raising standards through increased pupil engagement in course work and success in assessments, as the following extract illustrates:

> *Vocational subjects are the driving force for widening participation in education, not the traditional academic subjects, but subjects that the pupils enjoy such as BTEC Sport, Leisure and Tourism, Health and Social. Pupils can deal with the assessment and progress onto the next stage, which is why we have higher numbers applying to college this year. Technology has played an important role because a lot of the vocational courses are timetabled into computer rooms to produce course work. Two thirds of their time is spent on computers researching areas or processing reports, handbooks, guidance*. (Janice, Assistant Head teacher)

Podcasts were to be used for accelerating learning, for example using media technology as a first diploma in BTEC in Year 9 as part of a pilot study for the Qualifications, Curriculum and Assessment body (QCA).

Several examples of using technology to support assessment for learning were described by teachers. These included the following account of peer assessment in PE:

> *We use Powerpilots when we are assessing, so we can go out onto the field, take the power pilot out with us, put the information onto EXCEL, back into the office, straight onto the computer, link it up, and there it goes* (Mike, PE teacher).

Filming peer assessment for learning and sharing the formative assessment process with others was also reported in Art lessons, alongside the use of video diaries for capturing the development of a piece of work such as a clay model. Filming peer assessment and video diaries promoted pupils' independent decision making about the outcome of a creative learning experience or event.

Online testing and the immediacy of feedback was regarded by teachers as a powerful motivator for pupil learning, leading to increased confidence and belief in pupils' own abilities through their success in BTEC, EDEXCEL and OCR (national qualification exam board) courses. Teachers emphasised the role of technology in facilitating module work, portfolios and interim tests.

4.3 Using technology as a cognitive tool

The teachers' interview responses indicated several ways in which pupils use technology as a cognitive tool. For example, 'Open Mind', has been introduced in some schools to support conceptual development and thinking strategies in course work in various subject areas.

Interactive Whiteboards, previously used mainly as teaching tools in Secondary school classrooms, are now being explored as learning tools through which pupils manage, manipulate and communicate ideas:

> *Interactive White Boards and laptops are being used as cognitive tools rather than as replacements for exercise books and text books. We are trying to better learning on the part of students by moving into students using the Interactive White Boards as active learners, for example by adopting a teaching role in a poetry lesson.* (Jo, English teacher)

Using technological functions that allow pupils to annotate their word-processed work in various ways supports pupils' meta-cognition around higher-order thinking processes such as evaluation and explanation in their work in lessons:

> *We have used a form of annotation that they can use in other subjects as well, by using shapes we call 'call-outs', so they are not just writing, they are able to annotate their work in any subject by using this, to the extent that when it is an evaluation we use a thought bubble, its then obvious that "I think". It's the words that are so important in my opinion.* (George, IT teacher)

Critical thinking skills and improved learning outcomes are supported through video analysis, particularly in performance subjects:

> *We use a lot of visualisation work. The sort of technology we use in PE is a lot of video analysis for performance. We can analyse performance, compare it to professionals, looking at performance, how is it different, how can you improve it. A lot of the kids at the moment use the Smart Boards to pinpoint different actions to say that arm movement was incorrect and I don't look like a professional*. (Mike, PE teacher)

Simulations, on the other hand, are used in subjects such as Science to allow pupils to engage with concepts and ideas to which they otherwise would have little or no access:

> *Obviously a lot of the time with the simulations they get to the real world. They can understand the effect that it has on everyday life*. (Holly, Science teacher)

4.4 Promoting personalised learning

Teachers' interview responses presented technology as a powerful tool for promoting personalised learning both in and out of taught curriculum time, where learning is flexible in terms of content, pace, place and time. Pupils were given opportunities to access technology when required in some lessons to support initiative and ownership in learning, as this extract from an interview with a history teacher illustrates:

> *They use technology in the classroom on a regular basis, not necessarily directed by a member of staff, but on their own initiative. They are very much aware of the technology that is available to them and do use the technology of their own accord*. (David, History teacher)

The seamless use of technology in and out of lessons is described in the following interview extract from a PE teacher, which also suggests that technology supports shared learning by pupils:

> *I think that a lot of the information that we use in classrooms can go home with them and they can use it on computers, they can look up and find different clips on the internet, especially with injuries. They can find a specific injury, save it on their memory stick, bring it to school, use it as an example, hyperlink it, also that there are loads of examples*. (Mike, PE teacher)

Personalised learning is increasingly supported in the schools by putting their courses on the school's server. Some schools are also introducing e-learning approaches in designated lesson time to support pupils' independent work:

> *We wrote something called 'e-learning' which is very much about the kids doing it independently. We are very strong on independent learning here traditionally and it used to be a big paper chase but the server and the laptops handle that brilliantly. We use a lot of websites. What was the big leap forward from our point of view was the fact that we could put a lot of these onto our website… They can practice and hyperlink from other websites we have been talking about in lessons.* (Phil, French teacher)

The teachers identify differentiation as a main advantage the technology offers in the e-learning modules, as this reference to a German module suggests:

> *I think the advantage to learning is the independent aspect, for example when learning by themselves they can listen two or three times, so it is good for differentiation as well. The*

menus have set tasks, so there may be three different listenings, and the kids can tune in to one of those, which is very different. (John, German teacher)

The following extract, while not a specific feature of personalised learning, provides an related perspective on pupil learning with technology:

The links between the literacy and the learning word processing work just helps. I think the pupils find it relaxing. They get on the computer, they find it relaxing. A lot of pupils are quite daunted by science, if they are not very confident, especially some of the girls, they are a lot more confident in that sort of setting than they are in a practical. (Holly, Science teacher)

The extract above focuses attention on the potentially supportive role a computer might play in a lesson in increasing a pupil's confidence and engagement in a subject, particularly through word processing.

4.5 Using technology as an organising tool for learning

Teachers emphasised the developing use of school servers to support pupils in the organisation of their learning. In these cases pupils are given their own space on the school server to maintain their documents in files and folders, although in some schools this is restricted to IT.

Computerised information, regularly shared with pupils, indicates how many assessment points, pupils have accrued and how many they need to achieve the end grade.

In some schools and for some courses, such as BTEC courses equivalent to four GCSEs, pupils are provided with a USB to copy information from school and to transport it for working elsewhere.

4.6 Increasing opportunities for interactivity and social learning

Teachers associated the use of technology with the benefits of interactive learning and learning in social contexts. The potential of interactivity through laptops and projectors in teaching spaces was regarded as a major shift from technology-based teaching to technology based learning:

I think when the laptops first arrived and we had the projectors that was where things began to advance, teaching and learning changed enormously. That's the learning as well as teaching. It isn't just the presentation. (Phil, French teacher)

Teachers suggested that the technology is used to support a collaborative approach to knowledge building in some lessons:

We share information in lessons, and go into different sites. (Dave, History teacher)

While there was a recognition that opportunities for pupils to use Interactive White Boards as active learners were generally under-exploited, teachers who used them to support pupils' learning in this way expressed significant benefits for pupils:

Learning technology has made the students more engaged using the Interactive White Board. It focuses pupils' attention, motivates pupils and so prepares them for learning and achievement through learning. Pupils are using the Interactive White Boards as active learners. (Jo, English teacher)

Two of the participating schools are currently trying to develop a gaming platform for learning to increase pupil engagement. Serious consideration is being given to the pedagogy underpinning games technology. However, this is presenting a challenge, as the following extract indicates:

We are trying to integrate the gaming technology into the understanding of pedagogy and acquisition of skills in a particular subject area to make it more interactive and more engaging. You've got random games which reinforce certain things but don't give a learning programme which is properly constructed. To take

> *us to the next step we have to get skilled up in how people learn through this technology which we don't really understand and we don't know how to do it. That is where we have got to move to, and it will take another couple of years before we get there*. (Jane, Key Stage Co-ordinator)

Teachers indicated that school websites were also being improved in terms of usability and interactivity to engage pupils more in learning and in the curriculum, as this second extract from Jane's interview suggests:

> *The website is being redesigned to make it more interactive now, so that we have a less static site. Now things are more animated. We have built into it tests and quizzes and things that are using Flash animations and are progressing learning and reinforcing what they have learned* . (Jane, Key Stage Co-ordinator)

The teachers' interview responses suggested a range of pedagogical principles currently underpinning the use of learning technologies in Secondary school lessons. The responses also indicated that teachers are seeking to develop their principles for teaching and learning as uses of technology develop and are integrated in schools.

4.7 Guiding principles

Analysis of the interview responses presented above identifies a set of guiding principles that may inform teaching with technology to engage learners. In particular, the following principles may enhance technology-based learning across educational sectors and into Higher Education:

Keep up to the technology and the way students engage with it and use it as an educational tool;

Use games technology that is challenging for reinforcing pupil learning and preparing for assessments;

Provide open access to computer technology in taught curriculum time for researching or processing information, and explore a seamless use of technology in and out of taught curriculum time;

Increase learners' opportunities for interactivity and social learning through connecting laptops and projectors/interactive whiteboards in teaching spaces;

Use video technology to support critical thinking skills and improved learning outcomes through assessment for learning;

Use generic mind mapping computer software to support conceptual development and thinking strategies;

Use Interactive Whiteboards as learning tools through which pupils manage, manipulate and communicate ideas:

Introduce strategies for meta-cognition around higher-order thinking processes when working on and with text;

Use technology to support differentiated teaching and personalised learning;

Maximise the use of technology as an organising tool for learning;

Fully exploit the potential usability and interactivity the institution's server and website to maximise students' engagement in learning.

To further inform ideas about effective pedagogy for engaging learning with technology, the next section reports a case study of Secondary school pupils' learning with technology in a university context.

5 How Secondary school pupils learn with technology in a Higher Education context: a case study

A one day visit by a group of eight Secondary school pupils to the School of Education and Professional Development at the University of Huddersfield was organised to investigate the pupils' engagement in learning using technologies in the university setting. This would provide the opportunity to observe how the pupils use familiar and unfamiliar technologies in novel ways. It would also allow close analysis of how the pupils used technology as a cognitive tool, a social tool and an organising tool for learning. The unfamiliarity of the learning environment and the learning tasks would permit a fresh look at pupil engagement in learning using technology. From the pupils' engagement in activities using technology, we hoped to be able to capture their learning moves and their reflections on using technology to support learning.

The visit was regarded as a case study. The data collected during the visit from observations, activities, discussions and conversations using video and audio recorders, digital camera, and field notes were analysed along with pupils' evaluations and records of wikis. Parental and pupil consent were obtained for the data collection methods and for using the data for the research and its dissemination.

5.1 The pupils

The pupils who were involved in the case study visit attend a large Comprehensive school located close to the town centre**.** The school has close professional development links with the School of Education and Professional Development and is keen to develop its ICT capability and an e-learning strategy.

The pupils, three girls and five boys, were motivated and aspiring learners in Years 8, 9 and 10, and the majority were members of the School Council. They showed a positive interest in the university as a learning and social environment, and were relaxed, motivated, and enthusiastic about the visit and the learning activities.

Two teachers and one learning mentor from the school accompanied the pupils on their visit to the university. One researcher, two university technicians and two student facilitators were involved in the organisation and management of the visit, which involved workshop activities, social breaks including lunch, and a short tour of the University.

5.2 The activities

The main part of the pupils' visit focused on two learning activities, one using voting pads and the other based on collaborative problem solving. The activities were chosen to provide interactivity in contrasting learning contexts. The voting pads supported knowledge recognition and knowledge acquisition, whereas the collaborative problem solving supported constructive and creative learning.

5.2.1 Voting pads

The first activity used voting pads with Quizdom software to record answers to questions projected onto a whiteboard and subsequently to create and trial their own quiz questions using the voting pads. The aim of the activity was for the pupils to evaluate the potential of voting pads for supporting learning in curriculum areas and to learn how to use the Quizdom software to create meaningful questions. The research interest was therefore in how the pupils would engage with the voting pads as a learning technology and how they perceived their usefulness as a learning tool.

As an extension activity, pupils were asked to collaborate on creating questions for each other for use with the voting pads. This engaged the pupils in choosing an area of interest, considering appropriate wording and presentation, developing a sense of audience, and using the software in a creative way. Image 5.2 illustrates pupil engagement in this activity.

Image 5.2: Pupils collaborating on creating questions for an activity using voting pads

5.2.2 Collaborative Problem Solving

The second activity presented the pupils with a collaborative design and communication task based around the problem of designing and creating a web page advert for a new chocolate product. We were interested to find out how the pupils might customise the technology to meet their own learning and problem solving needs. We wanted the task we presented to the pupils to be an authentic collaborative problem solving task with an appropriate level of cognitive and social challenge.

After introducing the task and allowing the pupils a two minute discussion time as a whole group, the eight pupils were allocated into two groups of four. The two groups worked on the task in separate rooms and communication between the groups was only through the discussion boards and wiki. A wiki is an online page that people contribute to, and, in this case study, a wiki was used for developing the web page. The two groups were each comprised of mixed sex and mixed year groups. The particular group dynamics were probably previously untested, and the pupils were using technology in novel ways. We therefore expected that conflict and conflict resolution could be part of the learning experience, and we hoped to compare this expectation with evidence. Both groups were video-recorded as they worked on the task. While this added to the unfamiliarity of the learning experience, the pupils generally appeared comfortable with the filming process.

It could be argued that a number of task management strategies could have been introduced to facilitate the problem solving process, including delegation of roles; systematic approach to task exemplified using a protocol; demonstration and practice in using the wiki; and identification of enablers and constraints/inhibitors ("does and don'ts"). However, we judged that opportunities for pupils to explore the affordances of the technology and make adaptations might be restricted by structuring the task in the ways described above. Rather, we were keen to see how, by using the technology in autonomous and creative ways, the pupils might demonstrate initiative, communication skills, critical thinking and reasoning skills, and how they might proceed to work in a goal-oriented way in groups. Our research interest was, therefore, in how the pupils would use the technology to resolve the conflicts that might arise in a learning environment that was encouraging and supportive but not overly directed.

The activities and tasks were intended to provide opportunities for the pupils to use technologies in unfamiliar ways, to engage in different kinds of learning in terms of

knowledge acquisition and problem solving, and to respond to different levels of challenge. The activities were judged to be transferable to a range of familiar curriculum areas, including ICT and Multimedia; Design Technology; Personal, Social and Health Education; Business Studies; and English.

5.3 Findings from analyses of video and audio recordings and observations

The role of technology as a cognitive tool, a communicative tool, and an organising tool in pupils' engagement learning was identified through analysis of video and audio recordings and observations of knowledge building using voting pads and problem solving in a creative collaborative activity.

5.3.1 Voting pads

Voting pads were used in association with Quizdom software and a range of general knowledge questions. Quizdom allows multiple choice questions to be presented in PowerPoint format and displayed on a whiteboard. Pupils register their answers privately using the keys on the voting pad device, and receive feedback directly through the device. Feedback on the groups' responses may be presented in graphical form on the whiteboard. This indicates the overall level of accuracy in the group's responses while maintaining the privacy of the individual's response. Video analysis focussed on the stages and associated features of pupil engagement using the voting pads.

Video analysis suggested five stages of pupil engagement using voting pads. The stages and associated features of engagement are presented in Table 5.1.

Table 5.1: Stages and associated features of pupil engagement in using voting pads

Stage of pupil engagement	Nature of pupil engagement
1 Preparatory	Familiarisation with the technology
2 Selecting response	Considering the alternative answers and making a choice
3 Processing response	Using the handheld device to register a personal response
4 Reviewing response	Accessing personal feedback through the device and collective feedback through graphical feedback projected onto the whiteboard. Interest in individual and group identity as a learner.
5 Evaluation	Identifying the possible advantages and disadvantages of using the device, and suggesting practical modifications

The pupils used the voting pads to make multiple choice decisions about information presented to them and subsequently to review their knowledge in the light of rapid feedback. Learning was therefore about knowledge building through acquiring new facts or reinforcing or revising prior knowledge. In this context the pupils' responses and their subsequent learning moves were personal and private as opposed to social and shared. Analysis of video and audio recordings of the pupils using the voting pads, and additional observations, indicated a high level of pupil engagement and enjoyment in responding as an individual within a shared learning experience. The voting pads operated as cognitive and communication tools in support of learning. For example, pupils used the device as a cognitive tool to learn from their mistakes and thereby acquire new knowledge. As a communication tool, the device enabled every pupil to communicate an answer. It was interesting that social interaction between the pupils throughout the course of the activity, in the form of shared humour and indications of enjoyment, appeared to contribute positively to

the success of the devices as learning tools. No gender differences were apparent in the pupils' engagement with voting pads.
The video image presented in image 5.1 below illustrates pupil engagement in learning with voting pads, and captures the privacy of pupil learning within the shared learning experience.

Image 5: Pupil engagement using voting pads

5.3.2 Discussion on the benefits of the voting pads

Transcript analysis identified personal empowerment, applicability, teacher confidence and motivation, and reliability as the main themes of the pupils' discussion.

Personal empowerment was expressed through references to saving, shouting out, opportunities for everyone to have a go, the avoidance of arguments, and the ability to '*put whatever you think'*. Applicability referred to benefits to lessons in all subjects where pupils could demonstrate knowledge through tests presented in a similar game format.

The issue of teacher confidence and motivation raised an interesting pupil perspective on the digital divide between pupils and teachers, which was expressed in the following way:

> *I think teachers would find it hard to use it. I think teachers are set in their ways. I don't think they would want to use it. (*Jake)

The reliability theme underpins the pupils' justification for suggested modifications to the device involving a text messaging facility. Importantly this provides an example of how the pupils would modify the technology or use the technology as a lever for legitimately introducing other popular social technologies into the learning environment to support assessment for learning. This was expressed in the following way:

> *You could just guess and that wouldn't be very reliable. If you typed the answer in you'd know it more . Other people would know then if you know. It's not just guessing. Instead of doing the questions a b c d e, try and write the answer properly like you do in an exam, instead of just a tick box, and then the teacher would know if you had got a right answer or the wrong answer.* (Jed)

The transcript extract above illustrates how the pupils are able to see the possibilities and limitations of technology and draw on their own technological skills to enhance the learning experience.

5.3.3 Conclusions about pupils' learning with voting pads

The voting pads operated as cognitive and communication tools in support of learning as knowledge building. Findings recognise the potential application of voting pads in a range of

curriculum areas for demonstrating and extending knowledge. However, perhaps of greater importance is how technology might empower pupils to give personal and private answers in social learning contexts, and provide pupils with a voice as learners.

5.3.4. Collaborative creative problem solving activity

The pupils were videoed working on the creative problem solving activity in two groups in different locations. Video analysis focussed on stages of pupil engagement in the creative problem solving task using the technology as a cognitive, organising, and communication tool.

Video analysis suggests seven distinct stages of pupil engagement in the problem solving task using the technology, as presented in Table 5.2. The stages include a preparatory stage of familiarisation with the task and the technology; selecting; structuring; elaborating; restructuring; integrating; and evaluating (Mayer, 2001; Jucks et al, 2003). Multiple stages of elaborating and restructuring were observed. These are represented as repeated stages in Table 5.2 and are also indicated in the page list for the wiki (see Table 5.3).

Table 5.2: Stages of pupil engagement in problem solving for learning using the technology

Stage of pupil engagement	Nature of pupil engagement	Examples of linguistic markers of pupil engagement
1 Preparatory	Familiarisation with task and technology. Logging on and exploration; initial contacts	*'I 'll do the logo.' 'I'll do the descriptive writing''* *'I don't want to take control, but I'm going to'*
2 Selecting response	Problem seeking; goal defining	*'Are we going to go for cheap or high quality?'*
3 Structuring response	Makes design decisions; producing and evaluating initial draft ideas	*'Is it white chocolate and milk chocolate?'* *'It's well nice'*
4 Elaborating response (1)	Seeks or provides further clarification, ideas and information	*'How do you think it should appeal to teenagers?'*
5 Restructuring response (1)	Reflects on new information; responds to conflicting ideas; experiments further by manipulating existing design	*'We need to put the white chocolate down the side'*
6 Elaborating response (2)	Responds to conflicting ideas by seeking additional internet sources	*'We don't think the pyramid appeals to teenagers'*
7 Restructuring response (2)	Edits the design further in response to critical evaluation; uses new design ideas	*'Where's the white chocolate?' 'It's inside the outer layer of chocolate'*
8 Integrating response	Resolves conflict around key design details; present 2 similar but distinct outcomes	*'We need to put white chocolate down the side'* *'I'll do the company logo'*
9 Evaluation	Reflection; critical reasoning	*''The good thing was our team'* *''They took over some of our roles but we got it all sorted out'* *'We designed two logos of our own'*

Image 5.3 illustrates the pupils' engagement in selecting their response to the task, in which they interpreted the problem and defined the outcome.

Image 5.3: Selecting a response to the task

Despite difficulties presented by inter-group disagreements over task allocation, the pupils used the technology to engage quickly with the tasks in their allocated groups, and were able to work on structuring responses within the first five minutes of their engagement in the activity.

5.3.5 Conflict resolution

The pupils' engagement in the problem solving activity featured several examples of conflict between the two groups over the equitable distribution of tasks, interpretations of task requirements, and designs.

While conflicts often appeared in the pupils' discussion board posts they were often not resolved strategically through pupils' postings. The discussion board was not used effectively as a tool for negotiation and collaboration about group allocation of tasks or as a tool for collaboration on design ideas including the title of the web page, the company name and logo, the design of the pyramid to appeal to teenagers, the location of the white chocolate, text colours, and advertising details.

While conflicts were not resolved directly through the discussion posts, different conflict resolution strategies were applied using the available technology. One strategy was to explore the capability of the technology to create different web pages, develop ideas in parallel, and to save alternative responses to the task on different web pages. This permitted the pupils to record different creative responses to the tasks simultaneously.

Pupils often responded to design conflicts by seeking to modify and refine their preferred design in response to the discussion board posts of the other group. While often not fully resolving conflicts, modifications were attempts to assimilate different ideas, and may usefully be described as 'conflict resolution moves'. This is illustrated in the following discussion posts:

Group 2: *Where's the white chocolate?*

Group 1: It*'s inside the outer layer of chocolate.*

Editing was used to resolve conflicts in design, although restricted opportunities to edit and editing decisions also proved to be sources of conflict between the groups on occasions. This is exemplified in the between-group discussion posts (DP) and within group conversations (C) below:

(DP) 08:4:.24 Group 2: *You need to put white chocolate down the side to make it look nicer.*

(C) 08:28:19 Group 1: *They don't think those pyramids appeal to teenagers.*

(C) 10:10:19 Group 1: *Tell them to get off the page so I can edit this.*

(DP) 10:51:24 Group 2: *We are going to change the picture because we are making the*

logo

The importance of 'conflict resolution moves' is suggested in the number of modifications or revisions recorded in the development of the web page wiki (see Table 5.3 below).
Video analysis suggested therefore that the pupils used the technology in their separate groups in 'conflict resolution moves' to manage conflicts in the collaborative problem solving activity in the following ways:
To explore the capability of the technology in developing alternative ideas simultaneously;
To assimilate ideas from discussion posts;
To modify work in progress in the wiki;
To edit web pages
The affordances of the technology for the 'conflict resolution moves' identified above contributed to pupil engagement through sustaining their interactivity in the problem solving process.

5.3.6 The development of the web pages using the wiki

The page list presented in Table 5.3 illustrates how the web pages developed. The number of modifications suggests that cognitive, organisational, and communicative aspects of learning with the technology featured in the problem solving process.

Table 5.3: Page list for the wiki

Page name	Last modified by	Modification time	Current revision
The Super Pryamid	Group 1 (4)	12:12:48	13
The Super Pryamid	Group 1 (4)	12:25:01	5
Inside the pyramid	Group 1 (5)	12:25:47	1
The Super Pryamid	Group 2	12:26:04	11
The actual one	Group 2	12:27:55	6

The number of web pages created (N=5) illustrated how the pupils took the initiative outside the official web page space to create new web pages for developing alternative responses to the task. The web pages indicate the chronological development of the task response and the areas of disagreement or conflict between the two groups. In these new spaces pupils experimented with ideas of their own that might contribute to the final web page. This was evident in the page 'Inside the pyramid', which explores advertising ideas, and also the different versions of The Super Pyramid.

The authorship of modifications to the wiki suggests that the designated groups were involved fairly evenly in modifying the developing web page, producing two similar but alternative versions. The similarities of the outcomes suggest an 'overarching' ethos of collaboration, while the differences suggest 'conflict within collaboration'. The timings of the modifications suggest that. Had more time been available, the pupils would have addressed the various requirements of the task. More time would also be required for the pupils to move from a position of 'conflict within collaboration' to 'negotiated collaboration' in which the pupils would co-ordinate and synthesise their responses and negotiate a final product. Future research could usefully investigate the role of the technology and technological artefacts, such as saved web pages, in supporting the transition from 'conflict within collaboration' to 'negotiated collaboration' using technology in similar collaborative problem solving tasks.

Overall, the number of revisions to the web pages (N=46) indicates the amount of collective elaboration and restructuring in the problem solving process and suggests the overall amount of creative thinking, critical reasoning, decision making and adaptation by the pupils.

While representing an unfinished product, the final modifications to the web pages show that the pupils creatively and successfully addressed the majority of requirements in the problem solving brief in their separate groups using the available technology. This suggests that, using the technology, the pupils were able to partially meet the challenge of the task itself, with the exception of producing a collaborative final product. However, given the opportunity, whole group collaboration may have materialised at a later time. This was suggested by the review process, which is illustrated in image 5.4 below.

Image 5.4: Reviewing the web pages: partial view of 'The actual one'

The pupils were not able to use the technology to any advantage for negotiating problem solving strategies, collaborative problem solving online, or for managing team work in distributed learning environments. These are therefore indicated as possible areas of development in the use of technology for enhancing pupil learning.

5.3.7 Learning moves

The stages of engagement in the problem solving activity using the technology featured several examples of learning moves that were expressed in the pupils' conversations. This was observed in their use of the technology and in their task responses and outcomes. Learning moves included problem seeking and problem defining; customisation of the technology; critical reasoning including evaluating, defining, describing, explaining, and arguing; reflecting and collaborating; and drafting, revising, editing and presenting.
Examples of the learning moves are presented in Table 5.4.

Table 5.4: Learning moves in the technology-based collaborative problem solving

Learning moves	Examples of pupils' learning moves
Problem seeking	Attempting to establish the problem space by *'Are we going for cheap or high quality?'*
Problem defining	Conceptualising the task by 'The New Generation of Chocolate'
Customisation of the technology	Creating new web pages to maximise opportunities for ideas generation
Evaluating	*We don't thin k the pyramid appeals to teenagers*
Describing	*The white chocolate is inside the outer layer of chocolate.*
Explaining	*That's what I am trying to say. We need something that is unique (to appeal to teenagers)*
Arguing	*Why is it meant to be 'The Chocolate Box Company'?*
Reflecting	*That's the company logo –oh, I don't know if it should be. The company logo*
Collaborating	*'You need to put white chocolate down the side'*
Drafting	Establishing a design model: *Paradise Pryamid. This brand new chocolate is unique. It has three different layers of chocolate*
Revising	We need the logo of the company, not the logo of the chocolate bar
Editing	*We are going to change the picture because we are doing the logo*

The learning moves in Table 5.4 indicate moments of change in the direction or progress of the task response.

5.3.8 Pupils' evaluation of the group problem solving activity using the technology

An important part of the research into how the pupils used the technology as a cognitive tool, an organising tool and a communication tool to support their problem solving was the pupils' own evaluations elicited in a discussion session immediately afterwards.

Negative features of the task identified by the pupils related to task distribution, communication using the discussion board, and the time constraint of one hour. These features were identified as follows:

Difficult and confusing communications between the two groups using the discussion board, making the development of ideas difficult;

Lack of agreement on task distribution resulting in confusion and monopolisation of tasks;

Difficulties making collaborative decisions, leading to different outcomes produced by the two groups (for example the company logo);

Restricted background on web page making it difficult to personalise the product;

Inability to express emotions through the discussion board or to have insights into the emotions of the people communicating with you;

Poor team work and the inability to 'pull it together';

Insufficient time to communicate

The pupils were positive about the social and creative aspects of problem solving with the technology. In particular, the following features were valued by the pupils:

Working creatively within groups;

Team building within groups;

Successful product/outcome

5.3.9 How the pupils customised the technology

One of the characteristics of the 'Xbox generation' is the way in which they customised the games technology by changing the operating system to use the hard drive as a server.

Changing and adapting the designated functionality of technology in small ways could be an important indicator of engagement in learning with technology. We were, therefore, interested to see how the pupils might adapt and customise the technology available to them in the problem solving task.

The pupils were soon dissatisfied with and restricted by one computer per group and required computer access for all four group members in one room and for three of the four group members in the second room. This meant that pupils could delegate tasks between themselves within rooms and to a lesser extent between rooms.

The pupils customised the technology in the following ways:

The wiki was used as an editing facility;

New web pages were created to accommodate the pupils' ideas;

Attempts were made to extend the affordances of the technology, for example by changing the background colour of the web page, and coloured text was introduced as a compromise;

Images were imported using the Draw facility on Google;

The virtual classroom chat room facility was used to upload and edit social text around and tangential to the task.

The findings above provide evidence that the pupils explored and adapted the affordances of the technology to support personal and group responses to the problem solving task and to promote social grounding (Dillenbourg, 1999).

5.3.10 Gender differences

The groups were same sex groups and self-selected with the exception of the teachers nominating a boy to work with the three girls for equivalence in numbers. Levels of verbal

communication and social interaction appeared to be higher within the all-male group, as was the level of emotional expression ranging from enjoyment to frustration.

5.3.11 Conclusions about pupils' learning with technology in the problem solving context

Overall the research findings relating to the pupils' response to the collaborative design and communication task, using the wiki and discussion board facilities on Blackboard and Internet access, suggest that the pupils used the technology effectively as a cognitive tool and as an organising tool. The research identifies the following ways in which the pupils' use of technology engaged them at different stages of the activity, leading to learning moves and creative problem solving outcomes:

Adapting and customising the technology;
Supporting collaborative team work within groups;
Supporting dialogic learning;
Enhancing the pace of pupils' responses to tasks;
Supporting high levels of concentration and perseverance;
Supporting conflict resolution;
Supporting creative thinking;
Promoting critical reasoning;
Prompting decision-making;
Organising work through saving and editing;
Promoting evaluating, describing, explaining, questioning, arguing, and defining.

The present case illustrates how the technology promotes high order cognitive activity, and challenges the notions that technology makes learning 'easier', makes the learner more isolated, or reduces the need for social interaction.

While the technology led to purposeful oral communication within groups, the discussion board did not prove to be an effective social communication tool to support collaborative problem solving between groups. This finding suggests that effective communication for learning with technology in collaborative problem solving can not be underestimated or taken for granted.

In the present case study the discussion board was not used to communicate effectively between the groups, either in the distribution of tasks or in co-ordinating design ideas. The discussion board did not adequately meet the communication needs of distributed team work. In particular, discussion posts were not used in strategic ways to support collaboration or to progress design ideas. These findings might be explained in part by the novelty of the task, unfamiliar applications of the technology, and experiencing a different learning environment. However, the pupils' industrious application to the task did not suggest these were areas of difficulty. Rather, it appeared that in providing limited information and emotional expression, the discussion board posts were difficult to interpret and respond to in the loosely structured problem-solving task.

5.4 What the pupils' evaluations of the days' experiences revealed about their engagement in learning with technology

An important part of the case study was discourse analysis of the pupils' reflections and evaluations of learning with the technologies made available to them in the workshop activities. Six pupils successfully communicated their evaluations to the researcher through the discussion board on the university's virtual learning environment. The comments offer insights into pupil engagement in learning with technology that may usefully inform e-learning strategies and teaching approaches in the Secondary schools and at the University. For this reason the pupils' evaluations are presented and discussed in detail below. Pseudonyms are used to maintain the anonymity of the pupils.

5.4.1 Jodie

Positive thoughts – all the technology I saw today was useful to all students, getting their view points across quicker and more efficiently

This evaluation highlights the importance of the opportunity for student voice through inclusive participation and interaction that is meaningfully focussed on expressing pupils' viewpoints. The comment also emphasises the role of technology in providing pace in communication and in supporting the efficient and effective communication of ideas and views. However, Jodie also suggests that e-communication in the form of problem–solving conversation or dialogue was difficult and undermined the successful progress of pupils' response to the task:

Negative thoughts - the chocolate advertising on the computer was really muddled, conversations were really hard to get across.

This suggests that e-communications for problem solving challenged pupils' existing communication practices and did not operate strategically. It is therefore important and encouraging to note that Jodie was positive about the learning experiences using the technology:

How the day went- the day went very positively giving us all a new insight into new technology that we could use in the future.

The comment above indicates the importance Jodie placed on gaining new insights into uses of technology for learning.

Jodie's final comment conveys a sense of technology as a flexible cognitive tool and an approach to learning in which fitness for purpose is achieved by adapting the existing technology:

How it could be better for us- the technology could be improved and made better for us once we need to learn about the job we want.

5.4.2 Carl

Carl also draws attention to the importance of technology for enhancing social learning, cooperation and collaboration. Carl's evaluation suggests that the combination of the technology with the group dynamics led to sustained engagement and perseverance in working on the tasks:

When we did the group work of four I thought it definitely worked, but somethings like the background you had no option that you could see. Altogether the day was very enjoyable. The best part was definitely the group work. That was something that I haven't done. It's a shame that we couldn't have longer doing the group work, and it's a shame we couldn't have longer doing the voting pads

Carl's comments also highlight the importance he places on 'option', suggesting the importance of choices and a need for a degree of control and ownership. This illustrates the importance placed on the affordances of the technology, and how they might be explored and manipulated.

5.4.3 Jake

Jake's evaluation focuses on usefulness, enjoyment and creativity as features of engagement in learning with technology:

I enjoyed the day at Huddersfield. I thought that the voting pads were very useful and this was something I enjoyed a lot. I also enjoyed the designing a chocolate bar, but I think it would have been easier if we were all in one room.

-Negative thought- I didn't enjoy working in the teams for the chocolate designing

Jake's evaluation suggests that while the technology successfully supported his creative response to the task, the combination of group dynamics and e-communication did not engage him in working as a team. Jake suggests that the potential difficulties associated with a distributed learning context were not resolved by the pupils' use of the technology. This would seem to indicate that distributed problem solving using technology needs to be

researched further to identify appropriate levels of communicative, organisational, technological, cognitive, and social challenge.

5.4.4 Ellie

In suggesting adaptations to the technology to maximise the potential for learning, Ellie highlights the need to support personal, emotional and social dimensions of learning collaboratively with technology:

> *There was nothing that I disliked because I liked everything. I think I would improve the communication when we were in the two groups in different rooms. I think you should have a web cam and a microphone so that you are telling them how and what you think, so that they can tell your emotions. In the future I would make it a lot easier to communicate with the other group when doing the chocolate task.*

Ellie suggests introducing popular social technologies such as a webcam and microphone to enhance communication for group problem solving. These technologies might supplement or replace the need to communicate through the discussion board, which was not regarded as an effective communication tool in the problem solving context.

5.4.5 Phil

> *Today I thought altogether was a great experience. We started off with the voting pads which I thought was very good to use and I think they would be really useful in some subjects if not all subjects. Then we moved on to the idea of making a chocolate bar which was a different experience because we had to talk to the other group through the communication chat room thingy. Overall I think that the technology of the day that we used will help pupils learn, especially the voting pads. I think the communication was bad between us all.*

While positive about the practical applications of the technology for engaging pupils in learning across curriculum subjects, Phil identifies the novel use of the discussion board for creative problem solving in a collaborative learning task, and identifies the difficulties the pupils experienced using the technology as a communicative tool for learning.

5.4.6 Gina

Gina highlights the role of technology in active learning through which pupils can sustain interest and achieve success:

> *I enjoyed today because there was lots of activity we could do and I was never really bored.*

Gina refers to her individual and group identity as a learner, suggesting that the technology mediates and empowers both. Gina indicates how the voting pads operate as a cognitive tool for pupils to think of their own answers, and as a communication tool providing an entitlement to respond, a space to respond, and increasing a pupil's identity and self-esteem as a learner:

> *The first activity we did was using the voting pad which I found really fun. It's always really boring at school because everyone just shouts out and you can't think of your own answer. With the voting pads you can have your own answer and nobody has to know what you put. I learned quite a lot from it. The only bad thing was that some people were sharing their answers and I overheard them when I didn't want to.*

Gina's evaluation draws attention to engagement through privacy and anonymity, and how technology might be used to secure a pupil's right to a personal, private response, not influenced by the answers of others. However, Gina also indicates that using discussion boards and wikis to communicate problem solving ideas requires respectful responses and reciprocation:

> *The second activity that we did was making a website for a brand new chocolate bar. We got split into two groups, then we had to communicate using this messaging thing and nobody took any notice of you.*

Gina's evaluation illustrates the importance of not separating or underestimating the social, emotional, cognitive and organising aspects of learning with technology for pupils to be optimally engaged in learning.

5.5 Conclusions

At a time when the University is developing its vision statement and e-learning strategy and strengthening its partnerships with schools and FE colleges, the case study presented a timely opportunity to investigate and learn from Secondary school pupils' engagement in learning using technologies in the university setting. The case study provides snap-shots of how technology supports learning as knowledge building and learning through problem solving. In particular, these snap shots allow glimpses of how the technology engages Secondary school students in learning from experience and activity, and learning through conversation and interaction (Conole et al, 2007)

Analysis of data obtained from video and audio recordings, photographs of pupils in workshop activities, discussions, evaluations, and records of wikis and discussion board posts indicated ways in which pupils were engaged in learning by using technology as a cognitive tool, as an organising tool, and as a communication tool.

Pupil engagement in learning using technology as a cognitive tool was evidenced by pupils making choices, reasoning and decision-making; structuring, elaborating, and restructuring ideas; describing, explaining, arguing, defining, and evaluating; reflecting; responding creatively; and customising the technology to support extending ideas.

Pupil engagement in learning with technology as an organising tool was illustrated through pupils customising the technology to suit their needs; distributing roles; manipulating information; accessing, uploading and customising sources; consulting the homepage; creating additional pages to develop ideas; viewing, developing, editing, and saving webpages.

Use of the technology as a communication tool to support learning was variable and task related. Voting pads were used successfully as communication tools for recording answers and displaying knowledge. However, the discussion board did not appear to support effective collaboration in problem solving. Discussion posts were not used effectively to support team work through negotiating with others or to communicate about the development of design ideas. This may have been task-related, either through the complexity or novelty of the task. It may also be a result of using familiar technology in unfamiliar ways. An additional explanation could be the level of social skill and social maturity required to use the technology effectively as a tool for conferring and co-constructing in collaborative problem solving scenarios (Barbaux, 2006).

Overall, the findings indicated that pupil engagement in learning with technology is enhanced when the technological learning environment provides for the social, emotional, cognitive and organising aspects of learning. These factors seem to be particularly important for problem solving learning, in collaborative learning contexts, and in distributed social learning contexts.

The case study permits insights into how some of the principles underpinning learning with technology, identified by Barbaux (2006), operate in specific learning contexts. The principle of 'situate and change' holds that learning is context-driven and benefits from activities with clear goals and that involve a trial-and error approach similar to that in problem-solving with video games. Activities with a game-like approach are said by Barbaux (2006) to promote motivation and challenge. The collaborative problem solving activity in the case study presented a simulation game context for learning. This engaged and motivated the students, and the use of the technology also presented a challenge. 'Confer and construct' refers to the provision of 'a shared conversational space where students feel free to express themselves, understandings are shared, perceptions are challenged, hypotheses are tested, and which makes the most of the dialectical relationship between the technological space and the semiotic space' (Barbaux, 2006: 139, after Taylor et al, 2006). The case study suggests that

sharing a conversational space in a distributed collaborative problem solving activity may be challenging for some Secondary school pupils, particularly for sharing understandings and challenging perceptions that move the activity forward in collaboratively constructive ways. The interface between technological and semiotic spaces may therefore be an important area for further development through exemplification, strategies and scaffolds if constructive learning with technology is to be maximised in collaborative problem solving contexts.

Referring to the principle of coalesce and contribute (Barbaux, 2006), the case study illustrates the challenges and conflicts in establishing a group identity. It highlights the challenges of identifying a common purpose and completing of tasks using technology in distributed collaborative problem solving using technology as the medium for communication and exploration of ideas. Findings from the case would seem to make a contribution to our understanding of learning with technology by identifying new areas of focus for teaching that might lead to more effective student engagement in learning with social technology in distributed collaborative problem solving. Importantly, the case highlights the need to support students' constructive learning by developing and extending their use of social technology for sharing understandings, challenging perceptions and achieving joint task outcomes.

5.6 Recommendations

The findings seem to have implications for developing pedagogy underpinning learning with technology and for developing a transitional pedagogy for engagement in learning with technology that spans the Secondary school, Further Education and Higher Education sectors. Based on the results of the case study findings several recommendations may therefore be made to support 'transitional pedagogy' for engaging learners with technology. 'Transitional pedagogy' refers to implementing a cross-sector e-learning strategy through which shared teaching approaches and strategies maximise the engagement of new generations of digital learners in and across the Secondary school, FE and HE sectors. In particular, the learning moves identified in the technology-based collaborative problem solving suggest that teachers might usefully consider the following:

How to support pupils in evaluating, describing, explaining and arguing through the medium of technology for learning (Ohlsson, 1995);

How to provide for student ownership of learning through problem seeking and problem defining;

How to support students' creative customisation of technology in support of learning;

And how to recognise and maximise significant moments of change in the direction or progress of the task response as students use the medium of technology to reflect on, draft, revise and edit their work.

The findings also suggest that particular attention could be given to developing the use of technology as a social communication tool in online problem solving contexts. In particular, how the use of discussion boards and similar social technologies might be developed as effective tools for collaborative e-learning and problem solving should be explored further.

It is recommended that further research be undertaken in pupils' and students' intuitive use and adaptations of technology in collaborative problem solving. Customising technology in the ways evidenced in the case study suggests engagement in learning through creative adaptations by pupils. To maximise pupil engagement in learning with technology teaching could recognise and, where possible, accommodate pupils' adaptations that increase fitness for purpose and improve the capability of the technology as a cognitive tool, an organising tool, and a social-communication tool to maximise pupils' learning.

Creative ways in which pupils may use technology to manage conflicts in collaborative and distributed problem solving contexts could usefully be explored, accommodated and encouraged.

Stages of engagement in learning with technology identified in the case study should be researched further in different subject disciplines and, perhaps, be given closer consideration

in teaching to maximize opportunities for learning. Finally, provision should be made for the learner's entitlement to both private and public engagement in learning with technology.
It is perhaps in these ways that new paradigms for learning with technology might emerge and new and more effective ways of engaging learners in taught curriculum time might develop.

6 The role of technology in engaging students in learning in Higher Education at the present time: students' perspectives

This section reports the findings about student engagement in learning from group interviews and individual questionnaires with undergraduates and postgraduate students registered on nine courses in the School of Education and Professional Development. A total of 110 students were involved in thirteen group interviews that sought reflections on their engagement in learning with technology while studying at the university. Of the students interviewed, 35students completed surveys about the role of technology in their learning while on their courses. Seventy-two surveys were also completed by students across university schools and departments. The findings from these additional surveys provided comparative information from the wider student population, which is reported below.

As it was not possible to interview students from all courses provided in the School of Education and Professional Development, the target groups were students on PGCE and PCET education courses who might be expected to have a particular interest in engaging new generations of digital learners. One group of post-graduate students who participated in the study attended a Further Education institution in the university's post-compulsory education and training consortium. The timing of the interviews and surveys towards the end of the course allowed the students to reflect on their own engagement in learning in the university settings in taught curriculum time and in designated study time. The post-graduate students were able to reflect on their learning experiences as students and as trainee teachers.

The interview responses and surveys were analysed for indications of how students are engaged in learning. Interviews revealed the embedded nature of technology in the students' independent learning, or learning in their designated study times.The interview analysis indicated that, regardless of respondents' ages or the courses they undertook, computer technology played an important part in the life-styles and in the independent learning, or learning out of taught curriculum time, of the students who participated in the study, as the following extracts illustrate:

> *Blackboard, the Internet, emails and messages…we are the computer generation, without it we would be lost.* (Kassim)
>
> *Well the entire time I'm at home I've got my laptop and its' on the internet and MSN and it's on constantly because it's there.* (Jane)
>
> *My lap top is my online library; without it I'd be lost.* (Tracy)
>
> *When I think how much I use the laptop I'd be lost without it, the Internet, email, I'd be lost without it really* (Kev)
>
> *The lap top that we have been issued with- that has been absolutely valuable and has become a trusted friend*. (Steve)

In addition, the students indicated that the ubiquitous nature of technology and its impact on their learning had almost taken them by surprise:

> *The trouble is now ICT has become so embedded you use it like you use conversation, without really thinking about it. You don't realise you use it so much*. (Sophie)

This made it difficult for students to separate the technology from their engagement in courses:

> *Having the facility of digital technology and all that hasn't actually made me do the course any better, or work better on the course, it's just something that's there.* (Sofia)

Moreover, learning with technology was regarded as an ongoing process:

> *The new technology is everywhere, not just in education, and we are learning to use it all the time.* (Katie)

At the same time, the distractions to learning that technology presents were also acknowledged:

> *The Internet is a great tool for stopping you learning effectively, because you sit down and immediately you mess about looking at things that have great personal interest and short*

academic relevance and then three quarters of an hour are gone. It's a consequence of technology. (John)

Findings from the student survey, reported below, provided further insights into how individual students perceived the role of technology in their own learning.

6.1 The Student Survey

A survey was developed to identify the extent and range of technology for learning used by the students on their university courses and the learning activity that technology supports (see Appendix 2)

The survey was completed in paper form by thirty-five Education students. In addition, seventy-two students across university schools and departments completed the survey online.

6.1.1 Results of the survey completed by education students

Of the 35 surveys, 74% were completed by male students and 26% were completed by female students. Of the responses made, 85% indicated that technology plays an important parting their learning.

Considering how much learning technology supported students' learning on their course, high percentages of students' responses in categories at least 'quite a lot' were found in the learning activities shown in Figure 6.1.

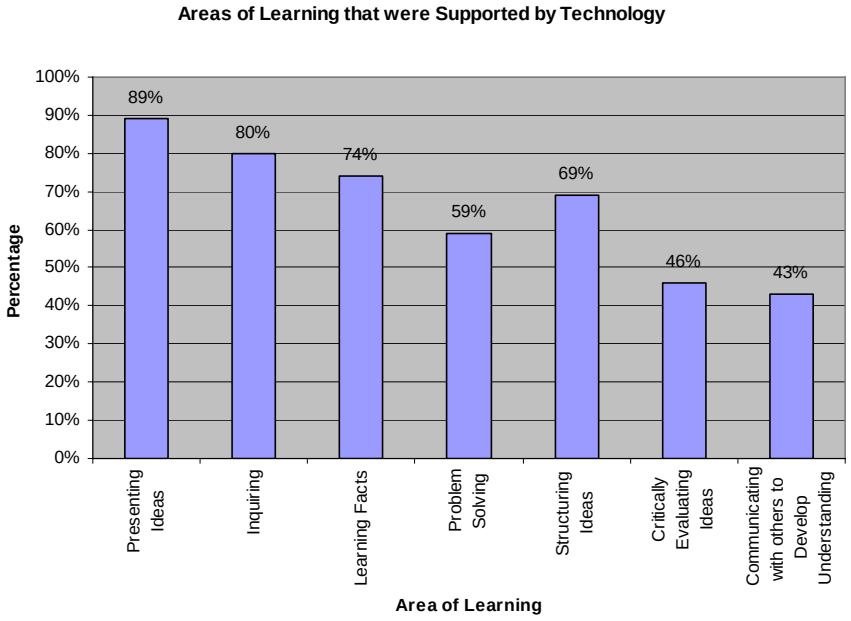


Figure 6.1: Areas of learning supported by technology identified by students in the School of Education and Professional Development

6.1.2 Results of the survey completed by students across other university departments.

Of the 72 surveys completed online, 57% were completed by male students and 43% by female students. Of the responses made, 95 % indicated that technology plays an important part in the students' learning. Considering how much learning technology supported students' learning on their courses, high percentages of students' responses in categories at least 'quite a lot' were found in the learning activities shown in Figure 6.2.

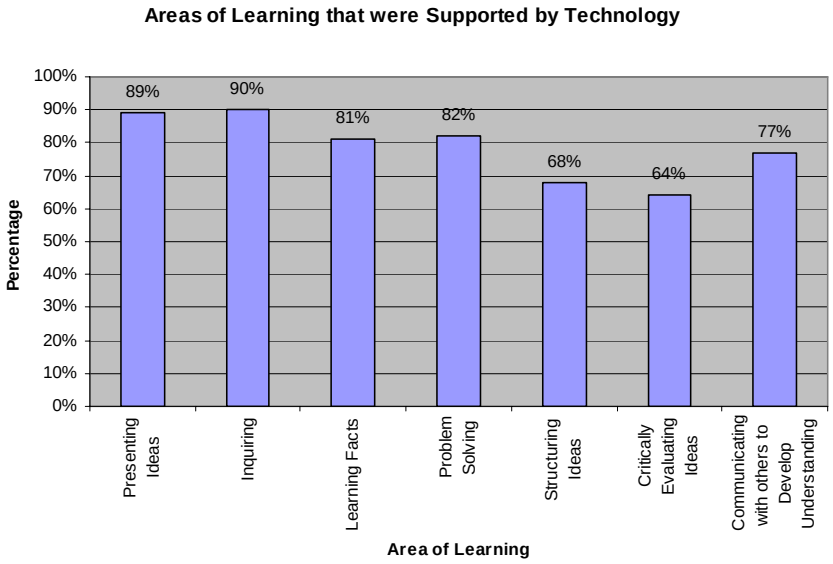


Figure 6.2: Areas of learning supported by technology identified by students across other University departments

Similarly, students identified the learning that technology supported most to be demonstrating improved subject knowledge (78%) and demonstrating improved understanding of concepts (75%). In contrast, students identified the learning that technology supported least to be learning as a member of a group of learners (58%), articulating preferences and justifying choices (58%), and demonstrating originality of ideas (65%)

Similar patterns emerged from the school-based surveys completed by students who were interviewed as part of the study and from students who accessed and completed the survey online through the university web site. While the findings suggest that technology provides students with an important cognitive, social, and organisational tool for engagement in learning, it appears that technology was generally used least often to structure ideas, to critically evaluate ideas, or to communicate with others to develop understanding. Importantly, it is these learning behaviours that would seem to appeal to new generations of digital learners (see Chapter 2 Section 2.2). This suggests a possible mismatch between the provision and deployment of technology for engaging learning currently in university courses and what may be expected and required by students in the future.

6.2 Findings from interviews with students

Group interviews sought to clarify the relationship between students' own use of technology for learning in study time, and the use of technology to support learning in taught curriculum time in their university courses.

The following themes emerged: disengagement through an over-use of PowerPoint; quality of resource provision; lack of differentiation in teaching; the need to develop, manage and apply information literacy; increasing engagement through interactivity; the importance of email and text messaging as social and organisational tools for learning; positive and negative features of Blackboard, the University's virtual learning environment (VLE), and student engagement in learning; the usability and usefulness of Metalib; and advantages and possible developments of the Associate Online Collaborative Project's shared virtual learning environment (VLE). These themes will be illustrated and discussed below.

6.2.1 Disengagement through an over-use of PowerPoint

Students reported being disengaged by a general over-reliance on the use of PowerPoint in taught curriculum time, as the following extracts illustrate:

D*eath by PowerPoint. Just absolutely boring. Just sitting and watching*

PowerPoints flick over and flick over. It's exactly the same at University (first degree). I've just come from a four year degree, and it's exactly the same here, but at least at university you have actually got practical work to be getting on with in tutor groups. (Matthew)

Similarly:

We've not seen technology used effectively. We all know how to use power point now, and we have been bombarded with it. (Sarah)

And:

Every lecture we have had here has been PowerPoint, PowerPoint, PowerPoint. It would be nice to have different styles of presentation so that people can develop different skills, rather than just developing the skill of reading a power point. (Mike)

The limitations of PowerPoint as a teaching method were indicated:

I don't think power point should be used to deliver things. You should find other ways to do that. It should just be a guide, or a help. (Alice)

Where other ways of engaging students were reported, the benefits for learning were identified, for example the importance of visual images from videos and film from computer to support visual learning.

The relationship between the use of technology in taught curriculum time and in designated study time is highlighted by several students who suggest that replication of information is disengaging, as the next example shows:

We have lectures where at the start you are given the slides, you are told that all the information is on Blackboard, and then you are sitting there for an hour while they read through the slides, and it is really frustrating. Why do I need to be here listening to somebody reading it when I can read it myself, and probably take it in a lot better? (Heather)

6.2.2 Resource provision

One student commented critically on the overall quality of technology for supporting learning:

The technology that you have got is a bit behind. (Helen)

However, other students spoke positively about how the technological provision had supported their learning:

They lent us a multi track recorder to take home, and that was quite useful. (Heather)

Where USBs had been provided, students felt their learning had benefited from file sharing. In addition, some students commented how their learning had been enhanced by the availability of specialist software, for example:

*Audacity for recording, changing frequencies of sound, inverting sound, I didn't have a clue about that before, so I feel much more confident (*Alice)

However, in some courses difficulties were reported in accessing specialist software required for learning:

That is my main criticism, that some of the packages you have to come into the university to use them. I suppose it is down to software licensing, but I come a long distance sometimes just to access a bit of programming. (John)

Similarly:

We were expected to do things where we did not have the software installed on our machines that we had most use of, so we had to go round looking to get that software. (Ikram)

On these occasions student engagement in learning was not maximised.

6.2.3 Lack of differentiation

Students reported some disengagement in learning at the beginning of their courses as a result of a lack of differentiation in teaching. This perceived lack of differentiation was related to students' technological capabilities and how they might be harnessed in learning:

We are all coming from totally different backgrounds. Lots of us have had lots of

different experience with technology within work and that's not taken into consideration anywhere is it? You are just brought in and taught from scratch. None of your work experience, what you have had before, is taken into consideration. It's got to be difficult because everyone is coming from different backgrounds, but there has to be some way between. (Josie)

Similarly, technology was considered to be underused as a means of addressing differentiated learning needs:

As you say, all that stuff at the start of the course is just not necessary and maybe there is some way to put that on some kind of system where people can access it where people need it, but not necessarily for everybody. In the first couple of weeks people were bored. (Chris)

Strategies were suggested for improving students' engagement in learning at the start of their courses, for example:

Maybe a couple of days before the course starts an induction for those who haven't used systems (Blackboard), so that when the course starts they can concentrate on the important things. (Jill)

This suggests that student engagement in learning may therefore be partly determined by minimising induction requirements where possible through a more differentiated approach.

6.2.4 The need to develop, manage and apply information literacy

Some students showed an awareness of the need for critical analysis of information they might access through Internet sites, for example:

There is so much information on there that you do have to be careful how relevant and how true that information actually is. You could get some information off a site which actually isn't factual at all and I think you just have to be careful about the facts of the information that you are using. (Wasim)

However, issues were identified in students' responses around engagement in learning using Internet sources. Inefficient sorting of information was highlighted in the following extract:

I think I'm a very good collector of stuff off the Internet and I mean to read it all but I don't I think it is very easy to download things where there is only a small amount that is relevant. If I was reading it (the information) in books I would sort the information much more efficiently than by using the Internet. (Jenny)

In the next extract superficial reading of Internet text was described:

I find it hard to read long documents on the computer, so I tend to skim read and *not read in depth.* (Lucy)

While critiquing and evaluating Internet information were cited as assignment requirements, little sharing of critical analysis was indicated, for example:

We don't critically share information formally… we evaluate it ourselves really. (Sammy)

There is also a suggestion in some students' responses that the use of internet sources may lead to superficial learning, or learning to complete a task, as opposed to deep learning or learning to extend personal understanding:

Now that we have lesson plans (from the internet) we can go and have ideas, pick what we like, and it saves time. It gives you ideas. All things are already prepared, so we can look at it, have an idea and pick what we want. (Yasmin)

Criticality was often associated with pragmatics and usefulness, for example when considering online resources *'just picking things that are relevant and adaptable'.* (Maya)

6.2.5 Increasing engagement through interactivity

Students reported being engaged in learning using interactive whiteboards in two courses represented in the study. In these cases, the technology was used as a cognitive tool to develop conceptual understanding, for example:

We often do lots of mind maps where we have to go up and write things on it. (Gina)

However, the majority of students reported little engagement through interactivity in taught sessions:

> *My understanding of Higher Education is it is just PowerPoint slides and a lecture really. You are not engaged much. You might have separate classes where they do engage, but when someone's teaching to you is just delivery, I think that needs to change really.* (Alice)

Comparisons were made between pedagogic principles underpinning active learning and the students' own experiences of teaching and learning:

> *Thinking about engaging twelve to sixteen year olds, I don't think the university has the same culture about engaging us, because quite often we would be sitting in an hours lecture, where you would concentrate for ten minutes and then just drift off.*

Similarly:

> *They tell us that the kids get bored watching people say what is on the Whiteboard, and then we get the same thing. The kids find that boring and so do we.* (Vince)

Some trainee teachers had learned to explore the potential of the Interactive Whiteboard as a learning tool from teachers on placements and through their own experimentation:

> *I think it's how you use the power point. It's not just you can put bullet points and pictures, you can create it so that using the smart board you can come up and annotate and scribble all over , and you don't have to use it as delivery, you can use it as interactive using the same kind of software.* (Anna)

Students pointed out that this did not reflect their experience as learners, and suggested that opportunities for their increased engagement in learning through interactivity using devices such as Interactive Whiteboards and other devices were under-exploited:

> *The lecturers don't use them. They seem to project things using power point onto the screen, but they don't ever use it. There is all kinds of equipment available in the lecture theatres, but they are not used.* (Jill)

The findings suggest therefore that limited interactivity and under-use of available technologies in taught curriculum time leads to reduced engagement in learning by students.

6.2.6 The importance of email and text messaging as social and organisational tools for learning

The social technologies of email and text messages were considered to play an important supportive role in the various stages of students' learning. This included text messages from tutors about meeting times; tutors keeping in touch and supporting students to keep on course and on schedule with assignments; emails in preparation for a tutorial meet, in drafting work, and in providing immediate feedback from tutors.

The following extracts illustrate the supportive role of emails in formative assessment:

> *We can email copies of our assignment (to our tutor) and she can then email us back telling us what we need to change, and that make sit a lot easier and gives us that support that we wouldn't have otherwise.* (Jill)

Similarly:

> *Tutors will just highlight things on Word, which makes it easier and cuts down on the amount we have to go through in tutorials and focus on the more important stuff.* (Stacey)

The example above illustrates how technology may be used to create time for increased engagement in learning.

The importance of email and instant messaging for co-operative and collaborative learning is also emphasised:

> *We email each other about our work, for clarification and sharing ideas.* (Nirmal)

And similarly:

> *For group work via MSN instant messenger we email each other our documents*

and then just chat about it. (Ruby)

The student culture of sharing learning experiences using a range of social technologies was particularly strong in one cohort of students:

We often do presentations in the class so what we will do is email each other our presentations or if we find anything useful we will email it to each other or post it on Blackboard, or different games or activities we have found on the Internet, just email them. (Grace)

The extent to which the facility of email contributed to students' engagement in their courses is exemplified in the interview extracts below:

Email for me is what I use all the time to communicate with everybody. I wouldn't be able to carry out my studies without that I don't think, even people just sending presentations. (Hilary)

Similarly:

Tutors are very approachable, always get back to me very quickly. We couldn't have done without that. (Milly)

and

Emails, they are a life-line, between us and our tutor. I don't know what we would have done without that. (Sue)

While it was clear that social technologies played an important role in engaging students in learning, one student described the possible limitations of email for learning in the following way:

IT can allow you to convince yourself that you are engaged in communication, particularly with email, because email allows you to ask a question on screen and send it, so you can find yourself in a position of sending lots and lots of emails to people or you might be a person who receives lots and lots of emails, in which case do you also have any time to answer these things?… It can be a continuous drizzle of unwanted contact. (John)

This highlights the need for learners to identify when a technological device functions as an authentic learning tool.

6.2.7 The use of Blackboard, the university's virtual learning environment (VLE), and student engagement in learning

Students reported a number of features of Blackboard that had supported their learning, including course information, assignment requirements, lecture notes, web sites, and information about related projects. The following extract shows how students used Blackboard as a cognitive tool and as an organising tool to support their learning and engagement in courses:

I've used it in researching what's expected, what other groups are doing. It's really useful for the assessment, the PDP files that we do because it has all the forms on, so instead of having to do the paper form you can just download them, type them up, print them off, and they are done and they are saved there. So that has been really useful. It has been useful to organise work as well. But there are also things like PowerPoint presentations and the creativity project. There's loads of things on creativity on Blackboard so that has been really useful. And doing background reading and thinking 'Yes, I've seen that!' It just helps to back up what we are learning. (Hilary)

Similarly:

I found Blackboard most useful because it gave lecture notes that you could download so if you had actually missed any lectures you didn't lose out because they were there for you to download. So that helped support the learning part of it. They also put additional information on, web links that you can go on to get more information if you wanted, I think that was the most useful thing that we have come across. (Milly)

From the example above we can see how Blackboard sustained student engagement by reducing the possibility of falling behind through missing taught sessions, and also by promoting the exploration of additional material to extend learning further.

The next extract conveys the significance of Blackboard as an organisational tool for learning for a particular student:

> *I'd say Blackboard has been most useful thing, because it takes out the need for having to contact people and check certain things. Everything is clarified using it. It works like a computer*. (Matthew)

For some students Blackboard had provided the structure and support for students to engage with and complete an assignment over an extended period of time:

> *We have had an assignment on BB that we have been doing bit by bit, compared to the other subjects, which had a big assignment to do at the end of this year. We only had about five-hundred words to do because we had been building our assignment over the course of the year, so that was really useful.* (Jill)

In this way, student engagement in the course was sustained through Blackboard's online developmental structure of assignment tasks.

However, while Blackboard was reported to support students' learning in the ways identified above, a number of negative features were also indicated. Students reported that the major difficulty they experienced with Blackboard was navigation:

> *It is very hard to find something. It takes quite a time to trawl through it I find. I it is not very easily signposted*.(Milly)

Several other similar comments reinforced this view, for example:

> *It just doesn't seem to be organised in a logical way. It probably is for tutors. It's not user friendly.* (Jill)
>
> *It is a filing cabinet with everything thrown in*. (Matthew)

The frustration experienced by learners in attempting to navigate the VLE is exemplified in the following extract:

> *There are quite tortuous paths to get to some things, and if it's not there you have to go right back to the beginning and then choose another path. And occasionally I'll find something and then forget where I found it and then have to try all the places again to find what I'm looking for, lesson plans, observation plans that sort of thing*. (Sarah)

Another disadvantage was the procedure required for saving information:

> *You can't save anything from there. You've got to copy and paste it into a word document, and that word document into another word document.* (Jean)

An additional criticism was that Blackboard contained material from previous years that might not be relevant and adds to the volume of information to be navigated. Furthermore, Blackboard was rarely used interactively for students to share resources:

> *If there was a shared resource (site) I think people would use it. There is a discussion board on Blackboard that has been used a couple of times. Some people have put ideas up, and I think if that were brought forward like a forum that encourages us to share resources that would be really good, to bounce ideas off people.* (Tony)

Some students reported that Blackboard appeared at times to be a substitute for tutor – student engagement:

> *It has made me feel very hands off though. I do feel as though I might as well have been on an Open University course studying on my own. In many instances because 'It's all on Blackboard' And it seems to be almost an excuse for lack of engagement that I feel that I should be paying for. Otherwise it is not differentiating this kind of university sufficiently from an Open University environment*. (Hilary)

While Blackboard was described as a repository of information, some students thought it was underused as a tool to support engagement in learning through social interaction:

> *I think if they concentrated more on using Blackboard as a forum it would be better.* (George)

However, other students preferred face-to-face discussions:

> *It has the technical opportunity for engagement in learning, which is all these forums and things, But I don't think very many of us have done that because you much prefer to do what we are all doing, which is to get in smaller groups and think and talk and meet.* (Hilary)

The role Blackboard might play in addressing different learning preferences was highlighted:

> *I differ from you. I prefer forums. I'm a bit awkward in groups, so I find that kind of communication (forum) fantastic.* (George)

Student engagement in learning may therefore be supported by accommodating different learning approaches and preferences where possible using the VLE.

6.2.8 Metalib

Where students talked about Metalib they were generally very positive about its impact on their learning, for example:

> *The biggest advantage to me has been able to access journals online, because we don't have access to paper copies at this college. It's fabulous.* (Molly)

and

> *We all travel for miles to get here. We don't have to go to the library. We can log on to Metalib, search for books, and read them at home, which saves you hours and hours of time.* (Josie)

The twenty-four hour access to the online library facility was valued by students. However, negative experiences of Metalib at the beginning of her course influenced one student's future use of the service in this example:

> *I had a few problems with Metalib at the beginning of the course, and I have just never got back to it if I am honest with you because I thought if it is so hard I just won't use it. My password didn't work at first, and a lot of the journals I was looking for they didn't have access to, so I just found it frustrating.* (Milly)

6.2.9 Associate Online Collaborative Project

This section draws on a recent online collaborative project undertaken in the School of Education and Professional Development (Williamson, 2007). The project is a tangent of the funded project Associate Online aimed at developing subject specialism for trainee teachers across four universities; Bath Spa, Greenwich, Huddersfield and Wolverhampton, with Huddersfield taking the lead role for the project to be launched in September 2007. The concept underpinning the project was that people match up online across the country. The intention was to engage approximately 5000 trainee teachers to support their subject specialism. This was in response to statements from the DfES and OFSTED that teacher training programmes in Post Compulsory Education and Training should give more attention to providing for subject specialism. The groups 'met' through a video conference and students to use the shared VLE using Moodle. A joint area evolved over the course of a year. Findings were obtained from analysis of unedited focus group video footage in which Art and Design PGCE students talk about the effectiveness of the project in supporting their learning.

The students identified several ways in which their learning had been supported through their engagement in the project, including more personal learning, easy access to useful material, and useful and comprehensive links providing a secure starting point for research, assignments and exams. Through their involvement in the project the students developed a learner identity and felt part of the community of learners. They reported educational benefits of feeling connected. Being subject-specific, the VLE was considered by students to provide important benefits for developing their own specialism.

The quality of discourse on the discussion board was described often as 'shallow'. The students did not find medium supported engagement in meaningful academic or professional dialogue. However, the value of writing on the discussion board as a self-reflective process and mindful of an audience was highlighted. The wiki facility was considered useful. Initially,

its usefulness was to establish social and academic grounding, but its usefulness as a learning tool was not sustained. The use of photographs as records of learning together and as memorabilia were considered important in sustaining engagement in learning through the project.

6.3 Recommendations

6.3.1 Recommendations made in the Associate Online Collaborative Project

The following recommendations were made by the students for improving the VLE for supporting student engagement and learning in the Associate Online Collaborative Project:
Redesign the VLE to provide visual impact and reduce the over-emphasis on text;
Include popular social technological features such as videos (YouTube), blogs, podcasts, links to personal web pages and MySpace;
Incorporate opportunities for personalised learning artefacts;
Include a site for seeking and sharing advice;
Include a dedicated site for students to share lesson plans and ideas;
Provide a facility to attach power point presentations ;
Develop a site for organising and storing important documents, files, handouts etc;
Provide cross-year access to resources for students to learn from the experience of other student cohorts;
Incorporate alerts to e-mail accounts on Moodle;
Match a buddy system by subject specialism and level taught;
Support student ownership rather than institutional control;
Recognise issues of intellectual property rights.

6.3.2 Recommendations suggested in interview and survey responses

The following recommendations for improving student engagement in learning using technology were suggested in the interview and survey responses of students who participated in the present study:
Introduce different styles of presentation and different methods of delivery using technology to increase student engagement through interactivity and to avoid 'death by PowerPoint';
Consider how technology might free up taught curriculum time for engaging students in important learning;
Change the current emphasis in the use of technology from a teaching tool to a learning tool; (eg PowerPoint; Interactive Whiteboard);
Improve the navigation of Blackboard;
Extend the function of the university's VLE as a repository to an interactive resource for stimulating academic discussion;
Achieve an appropriate balance between the 'virtual/hands off' nature of students' learning provided by the VLE and students' need for more social interaction to develop their understanding/cognitive engagement;
Give more recognition to students' prior experiences, expertise, technological skills and learning needs in teaching for personalised learning;
Make specialist software more accessible where possible;
Minimise induction requirements where possible through a more differentiated approach;
Develop information literacy and criticality for deep learning;
Embed and fully exploit email and text messaging as social and organisational tools for learning.

The next section reports perspectives of university staff and educational partners on challenges facing Higher Education in engaging new generations of students in scholarly learning.

7 Vision, capacity and challenges in engaging future generations of learners in Higher Education: perspectives of university staff and educational partners

Engaging the Xbox generation of learners in Higher Education is an aspiration shared by several diverse groups of practitioners educators and academics across the Secondary school, FE and university sectors who are keen to ensure a smooth and successful transition for learners across the phases of their education.

The concept of the 'Xbox generation' captures the creative problem solving and customisation that young users of the Xbox demonstrated in adapting and extending the console's capability, using it as a server to support their games activity. The research project is located within a context of significant change and development at local and national levels, and is directly linked to several current agendas including the following:

widening participation in Higher Education; making the learning process more engaging and accessible to students through the development of e-learning strategies, personalised learning and personal development planning; re-engaging students in the use of library and computing services; minimizing the institutional creation of a 'digital divide' through inequitable provision or teaching approaches; promoting a student-centred curriculum based on critical thinking and problem solving; transitional pedagogies in the context of 14-19 curriculum reform.

An important part of the present project was therefore, to investigate how significant interest groups and key players perceived the capacity of the University to successfully meet the challenges it faces in engaging new generations of digital learners who are often creative problem solvers and potential customisers of technology. Semi-structured interviews and focus group interviews were conducted over a four month period with lecturers, tutors and researchers in HE, the director of an outreach consortium, learning technology advisers, a Pro-Vice Chancellor, representatives of a local authority education advisory service, and teaching and management staff from the FE sector. Thirty participants were involved in this aspect of the research. All interviews were audio-recorded, and approximately nine hours of interviews were transcribed and analysed.

This section of the report presents the themes around vision, capacity, and challenge that emerged from the particular perspectives of the various respondents. The section is organised in the following way: a strategic view of the University's vision and capacity; issues raised in cross-sector and cross-institutional discussion; the perspectives of teacher educators; and the views of learning technology advisers.

7.1 A strategic view

Analysis of interviews with personnel at a strategic level in the University identified the following themes around the university's vision and capacity to engage new generations of digital learners: developing an e-learning strategy; investment in developing initiatives for technology based learning; and focussing on transitional pedagogy to support student engagement in learning at the university. The themes are considered below.

7.1.1 Developing an e-learning strategy

From a strategic view the concept of the 'Xbox generation of learners' provides a powerful metaphor for education and the engagement of students in learning, to which the university aspires:

> *The 'Xbox' captures a set of ideas about how you interact with something conceptual, how you are, engaged in a way that reflects how we want students to engage with their learning, to help them solve problems quickly, assimilating data*

all the time. We are trying to get them to rapidly engage with something that they are totally immersed in, that doesn't just engage them superficially, but learning that gets our students wanting to know more and more rather than superficial learning where they know less and less. The X-box project captures a particular set of behaviours as well as a particular piece of technology. (Pro-Vice Chancellor)

The current development of an e-learning strategy represents a commitment to increasing the university's capacity to engage learners in the ways identified above. A central factor in this capacity building is addressing the role of technology in the relationships and interfaces between students, tutors and knowledge. A second important consideration is the potential of social technologies for inspiring learners:

We are developing an e-learning strategy…It is concerned the way in which new technologies and new teaching methods help us to think differently about our relationship with the students and the relationship between the student and what they are learning. Professors who inspired me were the ones who could make me think differently, help me to ask questions and make the subject come alive something come alive, and I think the idea of blogs and wikis are crucial mechanisms to support this approach. I don't know whether we don't understand how to use these devices, but I don't think we are as far forward as we should be in creating a dynamic learning environment using the latest technologies, which is why the e-leaning strategy group making this a priority. (Pro-Vice Chancellor)

The e-learning strategy aims to promote individualised learning through providing for students' different learning approaches or preferences using technology, and by using technology to communicate formative assessment for learning:

I think the X Box project emphasises the individuality of learning so that students can learn at their own pace. If we are going to be successful with such a diverse student population then we have to use technology to support different ways of learning. We can also use this technology to evaluate and find out what works and how students are progressing. (Pro-Vice Chancellor)

In this way close supportive relationships are anticipated between personalised learning and ongoing formative assessments.

7.1.2 Investment in developing initiatives for technology based learning

The University's e-learning strategy proposes the establishment of an institute of teaching and learning. Through this initiative and infrastructure the University intends to review teaching and learning with technology across the institution, raise the profile of learning technology in the curriculum, support dissemination and consistency of good practice, and to provide quality resources:

The University is developing initiatives with new technology. We are exploring the possibility of establishing a new institute of learning and teaching. One of the ideas is to nest within it a centre for new teaching technology, where we have a base for development and evaluation and where we develop strategies for the appropriate use of resources with a community of people who are interested in developing new ways of supporting learning. Often people don't know what other people are doing in the university, and we need to think of ways to disseminate new or innovative practice. We are talking about an exponential growth in new technology based learning approaches in this country and we want to be the best. This requires significant investment…and a commitment to ensuring that the pedagogy underpins the technology and not the other way round. (Pro Vice Chancellor)

An emphasis on 'technology based learning' rather than 'technology for learning', will drive the significant financial investment planned to improve the provision and quality of student learning in the future.

7.1.3 Focus on transitions

In relating technology-based learning and curriculum transition, a new emphasis is being placed on cross-sector and cross-institutional partnerships to develop transitional pedagogy for student engagement in learning:

> *Transitions are crucial. It is about curriculum transitions that support learning.*
>
> *One example is the new specialised diplomas, which we perceive to be an admissions issue with a new qualifications tariff. The real issues however are the major pedagogic issues new qualification frameworks create for the university. We have got a new generation of students coming in to the university having already covered some of our first year material. Some of them are bored stiff and under-stimulated. Many come from a very 'colourful' environment, a very stimulating, multi-media environment…and they get here and what excites them isn't what we think excites them. So I think we have to work in partnership with schools and colleges to develop our curricula further in ways that stimulate and excite students with different expectations of learning technologies.* (Pro Vice Chancellor)

The introduction of specialised diplomas is raising a new awareness of students' prior experiences with technology-based learning and the expectations they will have about technological provision for learning in the university.

7.1.4 Recommendations

The interview responses presented above offer a strategic perspective of the **U**niversity's vision and capacity to engage future generations of learners in whose lives technology plays an important role. Within that perspective the following recommendations or guiding principles may be identified:

Work towards creating a dynamic learning environment using the latest technologies;

Demonstrate a commitment to ensuring that the pedagogy underpins the technology and not the other way round;

Think of ways to disseminate new or innovative practice;

Work in partnership with schools and colleges to develop the University's curricula further, in ways that stimulate and excite students with different expectations of learning technologies.

7.2 Cross-sector and cross-institutional views: the role of technology in enhancing teaching quality for engaging new generations of digital learners

7.2.1 Introduction

Local Education Authority Advisers, Further Education tutors and managers, and representatives of the University's research community focussing on enhancing teaching quality in different institutions took part in a focus group interview on transitional implications for engaging new generations of digital learners in Higher Education, with a particular emphasis on enhancing teaching quality.

From the cross-institutional discussions that emerged from this unique forum, it was possible to gain insights into various perceptions of factors relating to impacting on the University's capacity to engage new digital generation of students. The main themes identified were; redefining learning and teaching and introducing cultural changes in teaching practices; addressing discontinuities in students' learning experiences with technology; embracing innovative practices**;** and focussing on new learning styles, scholarship and information literacy development.

These themes are illustrated and considered in more depth below.

7.2.2 Redefining learning and teaching: the need for cultural change

The discussion identified the need for a review about pedagogy and learning across all the phases and in Higher Education in particular:

We do need to think about what the university is doing, what learning and teaching means for the university, but not just define it for what it is now, but accept that it is part of a process of being more flexible and responsive and constantly rethinking what we are about in engaging students with technology. (Kevin)

Reluctance by teachers to embrace new technologies for learning was associated with relinquishing control of the teaching situation:

There's a fear about all the technologies I think, because it is about redistributing the control… are that much more skilled , that much more literate in the use of these technologies… Well we just lock it down and pretend it isn't here and then we won't have to deal with it. (James)

It was suggested that in Higher Education a significant shift in teaching roles would be required, in which university teachers' control of knowledge would be relinquished, as information management roles become more important:

What we will be as academics is not providers of knowledge and providers of information and experts at everything, but what we will be doing is as students manage the information overload that they experience in their lives, so that they are sifting out the chaff and just getting the wheat, so what we are going to be concentrating on is managing the information, evaluating the information, recognising what scholarship is and how it works. We'll be working as guides and supporting them with the architecture to get to that point, rather than just delivering the information and delivering the knowledge.(Elsa)

A change in emphasis from learning outcomes to the learning process was identified as a requirement for engaging learners in Higher Education. However, it was recognised that this change would require a strategic focus:

And I think as an institution we are still very much harping onto the outcomes and we need to be thinking about the learning process… To get real progress I think it needs to be attacked at the core of learning as you were suggesting, because going back to the idea of assessing a learning process instead of outcomes is going to be very hard to achieve without coming from the very top of the university. There will be a large proportion of staff who will need to move to that. (Sam)

It was considered necessary to connect learning processes to and through the popular social technologies that new generations of students engage with:

What I am interested in is how do we harness that visual literacy, the connectedness for our students, and how can we merge our vles with places that they go to anyway, like Myspace, youtube. Facebook is becoming I think the most popular of those. How do we make the vles of those spaces porous.. Second Life and Moodle (Snoodle) are becoming more porous. And I think university online spaces and classroom spaces have got to embrace that porocity. (Elsa)

An emphasis was placed on soliciting learners' views to inform redefinitions of learning and teaching:

And I think we have to speak to students, present ones and the ones coming up to see what they want and what they expect from the university. (Fran)

and

I suppose it might be the case of involving this 'Xbox generation' themselves in actually designing, telling us what is interactive. (Hugh)

In particular, it was felt important to question institutional assumptions about students' expectations regarding provision for learning:

I think the key is just ask the learners… because you might be surprised by the answer really. (Mark)

This was exemplified by an Further Education tutor recalling a conversation in which a student had identified how new technology could inspire his learning:

'I want you to write a blog. I want teachers just to write blogs, because I'm interested in what they are interested in. Where are they learning now? Where are they getting their information? I want to go and read about them, what interested them, so I can get from that more information about what I am enthusiastic and excited about.'

(Lee)

The conversation recalled above, illustrates how new generations of digital learners see opportunities for popular social technology to be used in pedagogically effective ways.

7.2.3 From 'Powering down' to empowering learning

Engaging students in learning was associated with meeting their expectations about technological provision and minimising discontinuities in learners' use of technologies across phases and institutions.

Student disengagement in learning was associated with the concept of 'powering down'.

The term 'powering down' refers to learners not being able to access or operate their usual social technologies in their usual ways to service learning in classrooms. The term implies a disempowerment of learners who consequently function at a reduced capacity.

Student disengagement through 'powering down' in the University learning environment was articulated in the following way:

> *I hadn't heard the term 'powering down' before, but now I have it has suddenly become incredibly useful to me. I would imagine that students walking down the corridor that we can see through this window and into the classroom will suddenly feel disconnected, because they've got mobile phones, wireless, PDAs, cameras, whatever it is, and they spend a lot of their spare time online, FaceBook, YouTube, Flickr, sharing their lives in some ways perhaps in an unwise way and without too much regard for ethics and privacy but, you know, that's another thing altogether, but walking into a classroom where they are told to switch off their mobile phones, they don't have access to the web I think we are holding onto an academic paradigm which is fast slipping through our fingers…* and *I think they are going to sense that the powering down is getting worse when they enter a classroom than when they are walking into their school classroom*. (Elsa)

The final comment in the extract above suggests an urgent need to reconsider strategies for maintaining technological connectedness for engaging students in learning in HE.

Discontinuities were also identified in the provision and use of Interactive Whiteboards and virtual learning environments (VLE):

> *We don't have interactive whiteboards in the university and students are coming into the classroom and expecting a data projector,* (Elsa)
>
> *Well we have got Secondary schools now in Kirklees that are fully equipped with Interactive Whiteboards and they are in use all the time*. (Drew)

Similarly, reference was made to the purchase of an authority–wide VLE for all phases of compulsory education:

> *'We are developing that. We are starting to write courses now for the VLE. Some of our schools …write courses for the pupils using the VLE and they can access it at home.* (Drew)

The apparent discontinuities between sectors in learner experiences with interactive whiteboards and virtual learning environments (VLEs) were a cause for concern. However, it was recognised that the university had introduced a programme of research to inform improvements in teaching provision with learning technologies:

> *It is obvious within this meeting that secondary perhaps are far in advance to what I know that we are doing here… Because of the number of TQEF (Teacher Quality Enhancement Fund) and the University learning grants that have been bid for, we are trying to play catch-up, I suppose.* (Sam)

7.2.4 Embracing innovative practices for interactive learning

The concept of interactive learning was central to discussions around increasing opportunities to engage learners with technology. In particular, a distinction was made between teacher-centred learning and student-centred learning using Interactive Whiteboards. Examples of innovative practices using the virtual learning environment (VLE) for increasing student interactivity were described and rationalised:

> *We visited (another) college last week and they have had a rethink about interactive whiteboards. Their view now is that the content should be delivered through the VLE. The problem with the IWB is that it creates teacher-centred learning which is not accessible all too often outside the class. So what tutors are thinking is 'What we need to do is, yeah, lets have an interactive white board, but primarily lets get the interactive content in the vle; lets get the tutors to deliver the content using just a projector and a screen, or maybe just a projector shining onto a normal whiteboard so that you can use a pen to highlight it, or maybe yes use an interactive white board. But by embedding the VLE in content delivery the learners see that and it just fits with their culture. The thinking is that you use interactive content that is web deliverable… by embracing the VLE and any web enabled content that you can identify that does the same thing, you are able to make that leap really,… which is to get closer to web deliverable content.* (Lee)

Other ways in which the dynamics of interactivity might be captured and made accessible on the VLE were highlighted:

> *I mean I have seen some quite good stuff done with the use of an interactive whiteboard and screen recorder software, so a video is created and then is put up on the VLE, so there is a recording of the actual interactivity, and the actual dynamic aspects of the session* (Kevin)

The extracts above suggest emergent ways of utilising available technologies to engage learners interactively over time and space. The distributed nature of students' learning and the relatively small amount of time students spend in a controlled learning space were recognised. It was seen as increasingly important for academics to use technology to break the model of support to students, which is currently often rigidly synchronous in time and place.

7.2.5 New learning styles, scholarship, and information literacy development

An emphasis was placed on recognising and accommodating the new learning styles that students are developing with technology to support their engagement in learning:

> *We are trying to get them to identify their own strengths, their own way they learn, the way they feel comfortable with learning best, and then put that in a framework which will be set out and apply those, bringing forward new ways of them accessing the curriculum, new ways of them accessing learning styles. We come out with a better learning experience that is called courses.* (Hugh)

Accommodating the development of students' learning styles with new technology was linked to notions of scholarship and information literacy. A changing role for academic tutors was identified in order to support good scholarship using technology:

> *The first wash (of information) that students get is not scholarly, its not refereed, it s not what we call academic research. I think in the next 5 years we are going to be much more open access than we are currently, as we currently have password protected access, as such we are much more concentrated with scholarly material, and we have to see this coming, because we are going to have to help the students manage this… We need to support our students in the management of how you filter out the misinformation from the real information.* (Elsa)

More direct focus on developing students' skills of good scholarship with technology was advocated:

> *We spend a lot of time telling then what bad scholarship is (reference to plagiarism), and we spend almost no time telling them what good scholarship is. Good scholarship is taking the information, filtering it, evaluating it, considering it, creating with it, and synthesising it.* (Elsa)

Similar issues of information literacy were reported in the Secondary school sector. This was regarded as perhaps the most important issue for transitional pedagogy:

> *Secondary schools have the same problem. Pupils have access to that sea of information, and what we have is a project called 'Organising Minds', which is about how do we get*

pupils to organise this information so they can actually come and write an essay in English, or write a design or evaluation in ICT . We are doing a lot more mind mapping, which doesn't have to be software, and we are also looking at 'double bubble', com paring and contrasting information, so there are projects going on that are supporting pupils. (Drew*)*

Information literacy and the associated emphasis on critical thinking were identified as themes to promote effective transition across educational sectors. It was concluded that increasing the capacity of the university sector to effectively engage new generations of learners would require a cultural change. In addition, the focus on developing communications, working partnerships and transitions between educational sectors should be enhancing technology-based learning.

7.2.6 Recommendations:

The interview responses presented above identify a set of recommendations for enhancing the University's capacity to engage future generations of learners who have grown up in a digital world. The recommendations, located in the respondents' discourse, are as follows:

Think about what the University is doing, what learning and teaching means for the University, through a review about pedagogy and learning;

Connect learning processes to and through the popular social technologies that new generations of students engage with;

Consider how to harness visual literacy and the connectedness for our students, and how to merge the University's VLEs with places that students go to;

Speak to present and prospective students to find out what they want and what they expect from the University;

Use interactive content that is web deliverable;

Bring forward new ways of students accessing the curriculum by recognising and accommodating the new learning styles that students are developing with technology;

Support students in the management of information by identifying strategies for supporting good scholarship and information literacy using technology.

7.3 Teacher Educators: Challenges and possibilities

7.3.1 Introduction

Semi-structured interviews with six tutors and two focus group interviews involving thirteen tutors were conducted in the School of Education and Professional Development at the University of Huddersfield to gain insights into current practices and future strategies for engaging student teachers in learning with technology. The education tutors were considered to be an important constituency as they worked directly with student teachers who would themselves be teachers of new generations of learners. Education tutors would therefore indirectly, but possibly not insignificantly, influence the school and college based learning experiences of future Higher Education students.

The interview responses suggested a climate of cultural change in developing the use of technology to engage learners in the future.

7.3.2 Establishing knowledge of students' technology skills on entry

Limited knowledge of students' technology skills on entry to courses was identified as an obstacle to engaging learners with technology when they begin their studies:

We never have a base where we are very clear where they are coming from. (Louise)

While generic courses are provided to support students' learning skills using technology, it is recognised that the skill level of some students will exceed basic requirements, and this is likely to be increasingly the case as new generations of learners enter the system. The information technology skills and practices of future generations of students will therefore need to be accommodated in teaching and learning, and alongside this more differentiated

technological support for students may be required in the future. In addition, the opportunities trainee teachers have on placements to engage learners with technology are currently dependent on the placements, and are therefore not certain or equitable.

7.3.3 Challenging assumptions about students' preferred learning approaches.

There is a recognition that assumptions about trainee teachers' learning styles and preferred learning approaches will need to change, and that a review of teacher training will be required to meet the needs and expectations of future generations of student teachers:

> *Adults like learning in communities, in face to face communities, and I think that in a sense probably hinders us from experimenting too much with e-learning, but I think the next generation coming up are learning that way. You only have to go into schools to see that they have pc labs, they download photographs from digital cameras, and so on, so I think we are going to have to be very responsive to the next generation*. (Mike)

7.3.4 Intentions and possibilities

Intentions for raising the profile of learning with technology are evidenced by plans to build day conferences and residential study units into the teacher training programme alongside ongoing work with tutors, in which trainee teachers use technology to engage with learning over the duration of the course:.

> *Wikis and blogs, and all these wonderful things that are coming in…all that top technology is really running fast at the moment, and I think we have to try and catch up with it the best we can. With our pre-service our age profile is changing towards the younger end.* (Mike)

The possibilities of technologies for enhancing how student teachers might communicate about their learning are being considered:

> *I think in many ways in teacher training we have tended to push 'blended learning' onto one side because we know that we encourage learning communities, we encourage students, when they have been on placement to come back and to talk their experiences. They are not just writing about it but they are also talking to each other, talking to the tutor, giving examples of case studies, there is that kind of line of communication. We are going to have to seriously look at some of that can perhaps be done through e- learning*. (Mike)

Similarly, anxieties and suspicions around the electronic availability of course material are reducing as the positive effects of 'blended learning' are recognised. Expectations of new generations of trainee teachers are also being considered. Overall, it is anticipated that adaptations to teaching practices will be required:

> *Where I think in the past there has been some suspicion around it, that if you have e-learning programmes, put all materials onto e-learning, and then people work from home, and do everything right up to passing the exam, or the exam is the only part they do at college. That isn't the case. There will always be the need for face- to-face contact, but blended learning is working better and culturally the younger generation will be able to cope with that and will expect to be taught in that way. So I think there are a lot of challenges for us.* (Mike)

7.3.5 The issue of credibility

Engaging students in learning is also associated with tutors' credibility in using technology, and this is presented as an important rationale for changes in practice:

> *I think increasingly as students come through they take for granted all sorts of new kinds of facilities for learning and exchanging ideas and so forth that it will become extremely difficult for teachers not to adopt those kinds of techniques, or they won't have any credibility with their students.* (Frank)

This is also highlighted by reports of inconsistent use of technology in teaching across courses. For example, Blackboard, the university's virtual learning environment (VLE), was reported to be used widely on some courses and less or hardly at all by others. In this way, the possible level of student engagement in learning with the technology could be associated with tutors' individual preferences regarding use of the university's VLE. Some courses, may therefore be regarded in higher esteem than others by students, based on how the technology is used by tutors to enhance students' learning experience. It would therefore seem important to establish the reasons for the reported inconsistency in the use of technology in teaching. For example, Blackboard is considered by some tutors to be too text based. This may reduce the capacity of the VLE for engaging learners, and would need to be reviewed to meet the needs of learners in the future:

> *If I was being really critical of technology in teaching I'd say it is too text based, it's not visual enough. We teach our students that there are different ways that students learn, visual, kinaesthetic, auditory ways, and then you go onto Blackboard and it is all text. It is only meeting the needs of some learners. The more creative and innovative visual approach to learning is the way that things need to develop.* (Louise)

7.3.6 Possibilities and constraints in the use of social technologies

The use of e-mail as a tutoring tool is becoming embedded in teaching practices, and appears to engage students in learning through formative assessment:

> *As far as I'm concerned it is unthinkable now that I could tutor students without email contact. It is so useful to see their work at an early stage and be able to comment on it and guide it and watch it's development… reassuring students that they are on the right track. That is (the role of technology in) formative assessment*. (Laura)

However, organisational constraints associated with issues of assessment, control and accountability also appear to prevent the creative uses of social technologies to support students' learning:

> *We have had discussions on my course about whether students can use MySpace and blogs for their reflections, and there are all these almost control issues from the team saying if someone uses that how do we mark it? How do we make sure they are not saying anything libellous? So I feel sometimes that we are constrained because of the way the organisation currently runs things, and we are sometimes being a bit negative towards students, saying 'No you can't use that as a reflective piece, whereas we should be saying, 'Well yes, this is a reflective piece. If you want Myspace to link up to YouTube, but there are all these reasons like 'What if it is a bad lesson and they know it is the University of Huddersfield, what of the libel issues, what of the slander issues?* (Jane)

Actual and anticipated constraints were therefore considered to obstruct expanding uses of popular social technologies in the service of learning.

7.3.7 Using technology to enhance learning in taught curriculum time

A model of student engagement in learning was proposed that involved learning technologies used widely in taught curriculum time:

> *I get a really, really good attendance on my courses because I have such a limited face to face and we have lots of supplementary activities to support that teaching and learning that happens outside of the face to face. I think it's getting the right balance. I think learning technology has got a lot to offer.* (Jenny)

Implications for increasing access to resources were identified for a seamless use of learning technology in taught sessions:

> *Why not have wireless computers in class? You could break off and say I'd like you to link up to the internet or have a dialogue with a partner HE institution when this has been set up as part of an e-mail academic community, or hook into the Associate*

Online. I think in many ways that would strengthen up the use of new technology if it's there, rather than go up to the second floor and request the wireless laptops for a particular day. What you are really doing is you are bringing in blended learning. It is just part and parcel of everyday learning. (Mike)

7.3.8 Online networks and virtual environments and for enhancing learning opportunities

Associate Online presents a powerful medium for engaging students in wider networked communities of learners. An interactive site for communicating about teaching and learning across consortium and partnership institutions using Moodle, Associate Online introduces the possibility for students to engage in learning about teaching and learning with technology through various subject specialist designated areas and discussion boards. Tutors identify the affordances and advantages of Associate Online for engaging students in learning:

I have been encouraging students to communicate with me, first of all to discuss their ideas, and for me to sometimes refocus it a little so that it has meaning for the specialist group. Moodle seems to offer more of a specialist focus for students. (Laura)

Following the success of the Penfield Virtual Hospital (University of Huddersfield, School of Nursing) for supporting learning through problem solving, it was considered that a virtual classroom would be a powerful electronic resource for engaging future generations of trainee teachers in learning about pedagogy. The virtual classroom would present authentic teaching problems in realistic settings, and would permit trainee teachers to use problem solving strategies in a familiar computer environment:

I'm interested in the possibilities for HE of the virtual environment and a realistic version. I understand that there is one in the Human and Health department, the virtual hospital, and for me one of the criticisms we get from our pre-service teacher training is that they want more experiences while they are here in the classroom, and I'm just wondering whether there is something that we could do to give them that, because there is a limit to what we can do on placement, and they can't expect everything when they go out on placement. But I like that approach to problem solving in a virtual environment. I suppose I like it because I enjoy doing that as well. I play a lot of games, and I enjoy that kind of problem solving, and I just wonder whether it might give an extra dimension to our students for us to do that. (Jane)

The concept of the virtual classroom appears to harness the appeal and challenge of the games culture, with the opportunity to learn about pedagogy through problem solving in authentic educational settings and contexts.

7.3.9 Recommendations

The following recommendations for engaging future generations of trainee teachers were represented in the tutors' interview responses:

Gain knowledge of students' technology skills prior to/on course entry to inform teaching and learning;

Accommodate students' technological skills in teaching and learning and provide more differentiated technological support;

Reduce organisational constraints preventing the creative uses of social technologies to support students' learning;

Increase access to resources to provide for a seamless use of learning technology in taught sessions;

Explore how technology might extend opportunities for students to communicate about their teaching practices;

Seek to provide more equitable opportunities for students to use technology to engage learners on placements;

Investigate the advantages of developing a virtual classroom as a resource for engaging future generations of trainee teachers in learning about pedagogy;
Redress a perceived over-emphasis on text-based material on Blackboard by more creative visual presentations of material to meet the needs of learners in the future;
Develop and extend the discussion forum and file sharing facilities of Associate Online as a resource for students to explore and extend their subject specialist knowledge and their professional identity in a community of learner practitioners.

7.4 Learning Technology Advisors

Learning Technology Advisors based in university schools would seem well placed to identify the institution's strengths and challenges in engaging learners, both currently and in the future. Two Learning Technology Advisors from schools in different disciplines were interviewed separately. The semi-structured interviews covered a number of issues around engaging students' learning with present technology and in future years. The main themes to emerge from the data were the relationship between pedagogy and technology; usability; the need for research; training; transition partnerships; translating the use of new technologies into education; and targeting technological support to need. These themes are considered below.

7.4.1 Putting the pedagogy into the technology

Establishing an appropriate relationship between pedagogy and technology and embedding this in practice were seen as the main priorities for supporting student engagement in learning. A focus on learners' needs would be required to ensure that the available technology, and the university's VLE in particular, is used to engage learners interactively rather than operating simply as an information store:

> *The challenge is in putting the pedagogy into the technology. That is the biggest challenge. Find out what the users want and turn the technology towards them. If there is nobody to drive the pedagogy behind technology, technology will always be just a repository, and that repository won't be used by people. If the pedagogy is driving the technology you will be able to make sure that the system can be tailored to the advantage of these students.* (Seth)

The dynamic aspect of the relationship between pedagogy and technology would also need to be given more consideration, where new affordances of the technology are exploited for learning, recognising how different and popular uses of the technology might inform pedagogy:

> *I think there is a much more subtle interplay between technology and pedagogy that has intertwined now because we use technology so ubiquitously. I feel that things need to move on almost in a two- pronged direction with a view to both things but holistically, taking the whole picture.* (Sam)

The interplay identified between technology and pedagogy implies the need to recognise and support how users customise the technology for learning, as well as the customary uses of the technology to enhance learning.

7.4.2 Usability

The current capacity and use of the university VLE for engaging students in online communication for learning using discussion boards is considered to be problematic. Perceived as not sufficiently user-friendly, the VLE system is under-used as an interactive communication tool. While some alternative open source providers are being used for Blogs and Wikis, these social technologies do not appear to be playing an important role in engaging students in learning at the institutional level at least. The following interview extract provides an important analysis of the current difficulties with usability and implies the challenges for improving usability in the future:

Usability is quite a big problem with Blackboard. An example of this problem is the discussion boards that do not seem to have any pedagogic underpinning in their development. The blogging and the wiki tool were provided by a different provider.

That provider is quite considerate when it comes to things like pedagogy. As a result you will find is that the blog and the wiki tools are more usable than the actual asynchronous discussions. On the other hand you have also got the synchronous discussions developed by Blackboard, but it doesn't compare to something like Microsoft MSN Messenger, which is a lot more smooth and streamlined. I would say the blogs and the wikis are used on two courses, around three to five percent of the students in the School use them. (Seth)

Seth continued to make important points about students' limited use of the VLE's discussion board:

Discussion boards are probably used for up to ten to fifteen percent of students in the School. Because Blogs and wikis are very new tools, some (tutors and students) are still using external providers, open source, and some are piloting the Blackboard tools. TheBlackboard blogs and wikis haven't really gone live. That is why we have not got a big uptake. Blackboard restructured their discussion board about a year ago and since that restructure the uptake has gone down from twenty per cent to ten to fifteen per cent, and I think it is because of the amount of structure involved. The use of the system is not very friendly for the students, so that has put people off using it. (Seth)

The extract above suggests that problems of usability mainly lie with the technology, but recognises that pedagogical issues exist around how social communication technologies might be used effectively to support learning.

The capacity of alternative VLE tools such as Moodle for developing teaching and learning platforms integrating social technologies in pedagogically effective ways presents a dilemma:

We've got Blackboard and it integrates reasonably well with the student record system, therefore changing that VLE to something that might be more useable and cheaper in the longer run may not be an option. Tools like Moodle, which is open source, can be tailored quite easily, the interface can be tailored to be used in a different way to Blackboard. Blackboard is more rigid and standard. Moodle has more potential for development. So that's a big issue. (Seth)

The dilemma, is therefore presented as a choice between sustaining existing systems or facilitating potential developments.

7.4.3 Research

The need was identified to research student views on learning with technology and the ways in which technologies impact on their learning. It was also considered important to begin to plan for future technological provision and technology-based learning by researching the learning behaviours and expectations of future generations of university entrants:

The important thing is somebody needs to go and do some research with the students to see what their views and opinions are on the technology, something that we seem to have failed to do in this institution. We may have done surveys on usability but there is nothing that can reflect on pedagogic use of the technologies. I think that case studies involving students from the secondary school sector experiencing learning in the university environment is the way forward. (Seth)

Another recommended strand of research, was to explore the potential of new technologies for enhancing student learning at institutional level:

My own perspective on university technologies is I want to move forward and try things out, because I see in a way that there has to be innovators, there has to be groups of people trying things out, but with an open-minded spirit of research in terms of is this adding anything to the learning experience. Can we generalise by saying yes, this is going to improve this particular part of the process? (Sam)

This suggests the need to identify innovative practices for technology-based learning informed by research evidence.

7.4.4 Training and partnerships in good practice

Staff training needs were linked to usability issues and to customising the technology for users:

> *Training is quite a big issue. A lot of staff need more skills to become more familiar with technologies. The tools themselves can be improved to make the usability easier for tutors and students.* (Seth)

The importance of learning from best practice using technology in partnership institutions was emphasised:

> *There are partnerships where teachers are facilitating, teaching, mentoring our trainee teachers, but it stops at that student. It doesn't filter up into the actual processes or practices of HE. I think that is what we really need to do. We need to engage with people to find out what we can learn and pick out the best bits and try and use them.* (Sam)

Developing cross-sector and cross-institutional partnerships for sharing and building on good practices was therefore seen as a priority.

7.4.5 Translating the use of new technologies into education

Learning with new technologies raised issues about potential changes in power structures in both teaching and learning in the academy, and how these changes might best be managed:

> *I think there needs to be a continued focus on all of our core activities, what kind of learning experience we want our students to have. There is a real dichotomy for me. Technology is changing the way that people communicate. It is changing things to do with power structures, so as technology enables people to communicate more freely it is making things more democratic in a way, and it is whether we accept that in the realm of education and are prepared to almost re-think education along those lines.* (Sam)

Within the context of changing learning cultures, it was considered important to be vigilant about the relationship between students' management of digital technologies and the quality of their 'work-based learning' in the context of module work and assignments:

> *I think this idea of the new students being multi-taskers and being able to several windows open on an application, a mobile phone, and doing other activities at the same time, I wonder how superficial that is, and I wonder how transferable it is to more of a work-based situation, whether it really is more about that social level of interaction.* (Sam)

It was proposed that the way forward for university schools and departments was to develop a means of 'critically examining these technologies in learning contexts and adjusting and being flexible'. Research was suggested to identify authentic learning contexts, for mobile and social technologies in the academy, and to inform how they might best be integrated into scholarly learning.

7.4.6 Planning to meet diverse needs

While an assumption may be made that new generations of learners will be technologically skilled and confident, it was emphasised that this may not apply in every case, and careful consideration would need to be given to the nature and focus of targeted technological support for students:

> *There is always this tension about where do you start in terms of using the technology. Quite often I think that one of the issues we need to think about as an institution in the university sector is how we provide that support in using technologies to students who need it, because it clearly isn't going to be everyone that needs it, but there is still going to be significant numbers of students who do need support and won't be familiar or feel confident with technology.* (Sam)

7.4.7 Recommendations

The following recommendations for engaging future generations of learners in Higher Education were identified in the interview responses of Learning Technology Advisors at the university:

Focus provision on learners' needs;

Explore ways in which the VLE may be used more widely and effectively as an interactive communication tool to support learning;

Consider how the university VLE will develop to meet the requirements of interactive learning;

Explore how social communication technologies might be used effectively to support scholarly learning;

Research students' views on learning with technology and the ways in which technologies impact on their learning;

Research the technology-based learning behaviours and expectations of future generations of university entrants;

Develop cross-sector and cross-institutional partnerships to inform good practices in technology-based learning;

Monitor the relationship between students' management of digital technologies and the quality of their learning.

The next section presents conclusions and recommendations that may be drawn from the study as a whole.

8 Towards maximising student engagement in learning

8.1 Conclusions

The project aimed to identify a research-informed 'transitional pedagogy for technology supported learning', by investigating examples of good practice in Secondary schools. Such pedagogy was deemed a feed-forward of skills for engaging learning with technology in taught curriculum time across educational sectors from Secondary schools to universities. The report presents the research project's findings and sets of recommendations based on individual and group interviews, lesson observations, a case study and pupil and student questionnaires. While the project was relatively short in duration, compared with other similarly funded projects and others referenced in the literature review, a substantive data set was collected. From this, the research project produced findings that may usefully inform how institutions in the HE sector might develop teaching provision that harnesses technology to accommodate the learning approaches and preferences of new generations of learners. In particular, the findings may support the development of a research-informed 'transitional pedagogy for engagement in learning', that is a feed forward of pedagogic skills using technology to engage learners across educational sectors from Secondary schools to universities.

A small range of embedded, developmental and peripheral learning technologies supported pupil engagement in learning in their lessons in Secondary schools participating in the research project. When used effectively by learners, these technologies were used as cognitive and organisational tools, and, to a lesser degree, as social tools for learning. University students used technology for learning in their own designated study time, or 'white curriculum time'. Students infrequently reported the effective use of technology for learning in taught curriculum time.

Characteristics of effective pedagogy for engagement in learning, identified by Pianta et al (2006), provided a useful tool for identifying teaching to support learner engagement using learning technology. Using this framework, associated indicators of pupil engagement in learning with technology could be identified. The taxonomy of pedagogy and pupil engagement in learning using technology might be developed and refined through further research into the effective use of learning technologies for successful scholarship by undergraduate and graduate students.

'Powering down' is in evidence in both the Secondary schools and in the university. Intentions for empowering learning with technology in both sectors are mainly confined to 'white curriculum time' associated with developments in the use of the institutions' virtual learning environments.

The mind-sets, motivation and attitudes towards learning and knowledge building of potential future generations of university students lean towards interactivity, appropriation, personalisation and creativity.

While technology based collaborative problem solving learning was not observed in classrooms or reported by pupils, the case study provided examples of learning moves, conflict resolution and customisation. These findings indicate important affordances of learning technology for learning creatively in collaboration with others, and for identifying important elements of that learning.

The findings highlight the important role of technology in transitional pedagogy for the engagement of learners, where cross-institutional and cross-sector liaisons and partnerships consider mutually informed teaching and learning policies. The need for particular attention to learners' information literacy, interpretation and information transformation is indicated.

8.2 Recommendations

Each section of the report concludes with a set of recommendations. These recommendations may be seen as discrete, focussed and relevant to the particular groups or case study from which they were derived. The recommendations are often interrelated and may be implemented within and across institutions and educational sectors, as appropriate. The recommendations may therefore best be regarded as a holistic set of possible strategic moves. They offer a possible agenda towards achieving transitional pedagogy for maximising the engagement in learning with technology of new digitally oriented generations of students.

In summarising the recommendations presented in the various sections of the report, we may return to the set of principles to support students' cognitive processes suggested by Sword et al (2007). These principles were to relinquish authority; recast students as teachers, researchers, and producers of knowledge; promote collaborative relationships; foster critical creativity; create multiple intelligences; encourage resilience and welcome challenge. The recommendations in this report often reflect the principles above, and situate them within the experiences and aspirations of the various groups of learners and teachers represented in the study.

It is possible to draw three main recommendations from across the various phases of the research project that both reflect and extend the principles suggested by Sword at al (ibid).

The first recommendation is that teaching at the University needs to explore the affordances of technology as a learning tool as opposed to a teaching tool in taught curriculum time, which would focus on student interactivity and higher-order cognitive engagement with the subject content.

The second recommendation is to minimise 'powering down' and maximise empowerment through learning with technology. Maximisation would be achieved by meeting the expectations for technological provision, quality, range, and customisation that new generations of university students expect and require.

The third recommendation is to focus on transitional pedagogy for engagement in learning with technology in collaboration with and across educational sectors, to ensure that the e-learning, and teaching and learning strategies in the University build on the best teaching approaches and provision that learners have previously experienced. Each recommendation has staff development and training implications, which would need to be addressed.

It is important to be reminded that participation in the research project was limited, and that many groups of key personnel, who are involved in and impact on teaching and learning in the schools and at the university, were not represented. The recommendations are not therefore considered to be complete and stand-alone, but rather may support a wider process of development and change involving a more dispersed participation, for example within and across various university departments and faculties.

The recommendations, and the data from which they are derived, may also provide discussion material for teacher trainers and for trainee teachers who are keen to make a difference and to inspire new generations of learners. Much will depend on the pedagogical approaches that they, in turn, are inspired to take. For this reason, the recommendations in this report, and the methodological and analytical processes underpinning them, will inform selected modular teaching in educational courses at the University of Huddersfield School of Education and Professional Development.

In order to inform current debates about developing policy and practice for teaching and learning at the University, the recommendations from the research project have been forwarded to the University's Teaching and Learning Committee and to the E-learning Strategy Group. In addition, a number of dissemination meetings took place with staff at the University and with other interested parties. It is hoped that the recommendations and outcomes will lead to sustained high levels of successful student engagement in scholarly learning and student satisfaction with the University's provision for academic success in future years.

8.3 The Next Steps

The University should adopt a proactive approach in considering some of the findings highlighted in this report to ensure it is actively pursuing strategies that are in the interests of the students. In particular, the Learning Technology Advisor, for whom this report was originally intended, must assert due attention to the set of recommendations relevant at School level and those that will inform his role in moving the SEPD forward. Actions in this category include further research and development in this area alongside engagement with local education providers and strategists across sectors.

Training and development in the SEPD should be negotiated with the Management Group and practical workshops should be hosted for staff. Relevant actions must be implemented through the LTA's annual e-learning strategy for the SEPD.

Each of the 'groups' identified in the project should aim to implement the relevant recommendations. This should be directed by the Senior Management in the University by highlighting Key Performance Indicators for each sub group to ensure recommendations have been implemented.

The Staff Development Group within the University should host workshops for University staff in using technology as a learning tool in creative ways, such as using 'concept mapping' via Interactive Whiteboards as opposed to linear content delivery through PowerPoint.

The University should support further research in this area to ensure that, as an Institution, it is well aware of the implications of changes in technological pedagogy and avoids student disengagement in learning through 'powering down'. To ensure that the gap between practices in HE and in other sectors is not left to widen further, appropriate steps should be taken to focus on and embed transitional pedagogy for learning with technology across educational sectors.

Funding has been secured from BECTA to take this research further and investigate the experiences of learners in terms of cross-sector transition and the implications it has across the various sectors. Findings from the present study and the BECTA study should be disseminated across the University and to other interested audiences at local and national levels.

It is imperative the University of Huddersfield maintains the cross-sector and cross-institutional networks that have been established through this project. Continuing professional dialogue across the education sectors about issues raised in this report will ensure that the University is in touch with and responsive to its current and future learners.

References

Barbaux, M. (2006) From lifelong learning to m-learning. Paper presented at ALT-C 2006: the next generation. 13th International Conference, Herriot-Watt University, Edinburgh. *Research proceedings , ALT-C,* Association For Learning Technology.

Becta, (2006) Quality principles for digital learning resources. *http://www.becta.org.uk*

Becta, (2007) Harnessing Technology schools survey 2007 (Becta, 2007) http://partners.becta.org.uk/index.php?section+rh&catcode=_re_rp_02&rid=14110

Creanor, L. Trinder, K., Gowan, D. and Howells, C. (2006) *LEX The Learner Experience of e-learning. Final Project Report.* August 2006. Glasgow Caledonian University and The Open Learning Partnership

Conole, G., de Laat, M., Dillon, T. & Darby, J. (2006) *JISC LXP Student Experiences of technologies: Final report*. JISC

Conole , G. and Oliver, M. (Eds) (2007) *Contemporary Perspectives in E-Learning Research. London*: Routledge

Dillenbourg, P.(1999) What do you mean by "collaborative learning?" Introduction in P. Dillenbourg (Ed) Collaborative learning: cognitive and computational approaches. Amsterdam: Pergamon

Dyke, M., Conole, G., Ravenscroft, A. and de Freitas, S. (2007) Learning theory and its application to e-learning. Chapter 6 in G. Conole and M. Oliver (Eds) (2007) *Contemporary Perspectives in E-Learning Research.* London: Routledge

Frand, J. (2000) The Information Age Mindset: Changes in Students and Implications for Higher Education. *EDUCAUSE Review 35, No 5 (September/October 2000): 15-24*

Hannafin, M.J. and Land, S.M. (1997) The foundations and assumptions of technology-enhanced student-centred learning environments. *Instructional Science 25, 167-202*

Harrison, C. and Weedon, E. (2004) SOLE Case Study Series: Education. Learning and Teaching Support Network and JISC. http://sole.ilrt.bris.ac.uk/

HEFCE (2006), *Teaching Quality Enhancement Fund*. March 2006/11. Available at http://www.hefce.ac.uk/pubs/HEFCE/2006/06_11/

Jarvis, J., Mavers, D., Saxon, D. and Woodrow, D. (2005)ICT Test Bed: Learner perceptions of the impact of ICT on their education. A Cross-Cluster Qualitative Study from the External Evaluation. *Evaluation of the DfES ICT Test Bed Project*. DfES: London

Lenhart, A., Simon, M. and Graziano, M. (2003) The Internet and Education: Findings of the Pew internet and Americal Life ProjectSeptember 2001. http://www.pewinternet.org/reports/pdfs/PIP_Schools_Report.pdf (Accessed April 22, 2003) In Oblinger, D. (2003)

Levin, D. and Arafeh, S. (2003) The Digital Disconnect: The Widening Gap between Internet-Savvy Students and Their schools. In Oblinger, D. (2003) Boomers, Gen-Xers & Millenials; Understanding the New Students. *EDUCAUSE review, July/August 2003.*

Lohnes, S. and Kinzer, C. (2007) Questioning Assumptions About Students' Expectations for Technology in College Classrooms. Innovate (http://innovateonline.info/) as: Lohnes, S., and Kinzer, C. 2007 Questioning assumptions about students' expectations for technology in college classrooms. Innovate 3 (5).
http://www.innovateonline.info/index.php?view=article&id=431 (accessed June 14 2007)

Martin, O., Roberts, G,. Beetham, H., Ingraham, B., Dyke, M. and Levy, P. (2007) Knowledge, society and perspectives on learning technology. Chapter 2 in G. Conole and M. Oliver (Eds) (2007) *Contemporary Perspectives in E-Learning Research.* London: Routledge

Oblinger, D. (2003) Boomers, Gen-Xers & Millenials: Understanding the New Students. *EDUCAUSE review, July/August 2003*

Oblinger, D., and Oblinger, J. (Eds) (2005) Educating the Net Generation. Boulder, CO: EDUCAUSE. http://www.educause.edu/ir/library/pdf/pub7101.pdf (accessed May 25, 2007)

Ohlsson, S. (1995) Learning to Do and Learning to Understand: A Lesson and a Challenge for Cognitive Modeling. In P. Reimann and H. Spada (Eds) (1995*) Learning in Humans and Machines. Towards an Interdisciplinary Learning Science.* Oxford: Elsevier Science Ltd, Pergamon

Pianta, R.C., La Paro, K.M. and Hamre, B.K. (2006) *CLASS: Classroom Assessment and Scoring System Manual, Middle/Secondary version 2006.* Center for Advanced Study in Teaching and Learning (CASTL), University of Virginia: University of Virginia Publications

Prenski, M. (2001) Digital natives, digital immigrants. On the Horizon 9 (5)
http://www.marcprensky.com/writing (accessed May 25, 2007)

Putman, D. (2007) In class I have to power down. Children's experiences of technology outside the classroom way ahead. *eG weekly, Tuesday may 8, 2007. EducationGuardian.co.uk© guardian News and Media Limited 2007*

Raines, C. (2003) Managing Millenials.
<http://www.generationsatwork.com/articles/millenials.htm Cited in Oblinger, D. (2003) Boomers, Gen-Xers & Millenials: Understanding the New Students. *EDUCAUSE review, July/August 2003*

Salomon, G. (1986) Information technologies: What you see is not (always) what you get. *Educational Psychologist* 20: 207-216

Somekh, B. (2007) *Pedagogy and Learning with ICT: Researching the art of innovation.* London: Routledge

Sword, H. and Leggott, M. (2007) Backwards into the Future: Seven Principles for Educating the Ne(x)t Generation. *Innovate 3 (5)*

Taylor, J., Sharples, M., O'Malley, C., Vavoula, G. and Waycott, J. (2006) Towards a Task Model for Mobile Learning: a Dialectical Approach . *International Journal of Learning Technology. Special Issue. Interactions, objects and outcomes in learning.* P. McAndrew and A. Jones (Eds).
Available at kn.open.ac.uk/public/document.cfm?docid=5374.

Timmis, S. (2004) *SOLE Project: Students' Online Learning Experiences*. The University of Bristol: JISC, ILRT.

Ward, K. (2007) *Critical thinking and problem solving: the Penfield Virtual Hospital*. Unpublished paper, the University of Huddersfield, Training and Development Seminar Series 2006/2007

Williamson, S. (2007) *"Such a relief to see something in my language." An investigation into the use of a shared VLE to support and enhance the learning and development of Art and Design Pre-Service PGCE (PCET) trainee teachers: A collaborative cross-institutional project.* Unpublished MA Dissertation, August 2007, The University of Huddersfield

Appendicies

Appendix 1. Secondary School Pupil Survey

About Yourself

1. You are

☐ Male ☐ Female

2. Studying in year

☐ 7
☐ 8
☐ 9
☐ 10
☐ 11
☐ 6.1 (sixth form)
☐ 6.2 (sixth form)

3. Do you like using technology in your schoolwork?

☐ Yes
☐ No
☐ Don't know

About Classwork

4. Which sentence describes you best?

☐ "I use technology in lessons to understand ideas for myself."
☐ "I use technology in lessons to help me get good marks."
☐ "I use technology in lessons to get the work done."

5. How often do you use these technologies to learn in school?

	not at all	not often	often	very often
a. Computer	☐	☐	☐	☐
b. Laptop	☐	☐	☐	☐
c. Interactive Whiteboard	☐	☐	☐	☐
d. Video	☐	☐	☐	☐
e. Mobile Phone	☐	☐	☐	☐
f. Camcorder	☐	☐	☐	☐
g. Personal Digital Assistant	☐	☐	☐	☐

h. Digital camera				
i. Other (please state)				

6. If you selected 'other' in question 6 please state which subject

7. How often do you use the Internet to learn in school?

- Not at all
- Not often
- Often
- Very often

8. How much does technology help you to learn in class?

- Not at all
- Only a little
- Quite a lot
- Very much

9. How often does technology help you to:

	Not at all	Not often	Often	Very often
a. Find things out				
b. Solve problems				
c. Sort out your ideas				
d. Make your work better				
e. Be critical				
f. Revise				
g. Talk to friends about school work				
h. Other (please state)				

10. If you answered 'other' in question 8 then please state what it is.

11. In which subjects does technology help you to learn most?

12. How much does technology help you to learn out of lessons?

- Not at all
- Only a little
- Quite a lot
- Very much

13. Do you have a mobile phone with file sharing facilities?

- Yes
- No
- Don't know

14. Do you use your mobile phone to support your learning?

- Yes
- No
- Don't know

15. Do you share files using your mobile phone?

- Yes
- No

16. Do you share files using other technology?

- Yes
- No

17. If you share files, which technologies do you use to share files?

18. How enthusiastic are you about learning with technology in school?

- Not at all
- Only a little

- Quite a lot
- Very much

19. Does using technology make you more interested in learning?

- Yes
- No
- Don't know

20. Which technology do you think supports your learning best in school?

About homework:

21. Which sentence describes you best?

- "I use technology in homework to understand ideas for myself."
- "I use technology in homework to help me get good marks."
- "I use technology in homework to get the work done."

22. How much does technology help you to learn with homework?

- Not at all
- Only a little
- Quite a lot
- Very much

23. How does technology help you to learn in these ways when you do homework?

	Not at all	Not often	Often	Very often
a. Find things out				
b. Solve problems				
c. Sort out your ideas				
d. Make your work better				
e. Be critical				
f. Revise				

g. Talk to friends about school work				
h. Other				

24. Please state 'other' if selected in question 23

25. Do you share files to help with your homework?

- Yes
- No

26. Does using technology make you more interested in homework?

- Yes
- No
- Don't know

27. Which technology do you think supports your learning best at home?

28. How often do you use the Internet to learn at home?

- Not at all
- Not often
- Oten
- Very often

Thank you for completing this survey.

We will let you know what we find out. We wish you well with your schoolwork.
M Sheard
J. Ahmed
Z. Ali
The University of Huddersfield
School of Education and Professional Development

Appendix 2. University Student Survey

About yourself:

1. Are you:

Male Female

2. Year of study:

3. Course:

4. What part does technology play in your life-style?

- A small part
- Quite an important part
- A very important part

About your learning:

5. Which sentence best describes your learning with technology?

- "I use technology on my course to understand ideas for myself."
- "I use technology on my course to help me get good grades."
- "I use technology on my course to get the course work done."

6. Which technologies have you used on your present course to support your learning, including subject specialist technologies?

7. Have the technologies you mention in your answer above played an important role in your learning on your present course?

- Yes
- No
- Don't know

8. If your answer to the above question is 'Yes', in which modules have technologies played an important part in your learning?

9. How much has technology supported your learning in the following ways on your course

	Not at all	**A little**	**Quite a lot**	**A lot**

a. To learn facts				
b. To enquire or investigate				
c. To solve problems				
d. To structure ideas				
e. To present ideas				
f. To critically evaluate ideas				
g. To revise				
h. To correct and improve work				
i. To communicate with others to develop understanding				
j. Other				

10. Do you have a mobile phone with internet and file sharing facilities?

- Yes
- No
- Don't know

11. Do you use your mobile phone to support your learning?

- Yes
- No
- Don't know

12. Do you share files using your mobile phone?

- Yes
- No

13. Do you share files using other technology?

- Yes
- No

14. If you share files, which technologies do you use to share files?

15. Which of the following technologies is the most important to you in supporting your learning on your present university course?

- ☐ Pc
- ☐ Laptop
- ☐ Mobile phone
- ☐ Interactive whiteboard
- ☐ PDA
- ☐ Other *(please specify)*:

16. To what extent does the technology you have identified in the above question help you to do the following?

	Not at all	A little	Quite a lot	A lot
a. Articulate preferences and justify choices	☐	☐	☐	☐
b. Experiment, take risks, try things out	☐	☐	☐	☐
c. Respond to the task in unpredictable or unusual ways	☐	☐	☐	☐
d. Make connections between learning in lectures and tutorials with outside experiences, influences and other learning	☐	☐	☐	☐
e. Adopt a variety of flexible roles as an individual	☐	☐	☐	☐
f. Learn as a member of a group of learners	☐	☐	☐	☐
g. Demonstrate improved subject knowledge	☐	☐	☐	☐
h. Demonstrate improved understanding of concepts	☐	☐	☐	☐
i. Demonstrate originality of ideas	☐	☐	☐	☐
j. Evaluate, analyse and reflect on the success of the work you do on your course	☐	☐	☐	☐

17. Please rank the technologies in order of importance to you in supporting your learning on your present university course, where 1 is highest and 5 is lowest

	1	2	3	4	5
a. Pc					
b. Laptop					
c. Mobile phone					
d. Interactive whiteboard					
e. PDA					
f. Other					

18. If you answered other please state

19. Which facility is the most important to you in supporting your learning on your present university course?

- Internet
- Blackboard
- Microsoft word or similar
- E-mail
- Text messaging
- Excel or similar
- Other *(please specify)*:

20. Please rank the facilities in order of importance to you in supporting your learning on your present university course, where 1 is highest and 5 is lowest

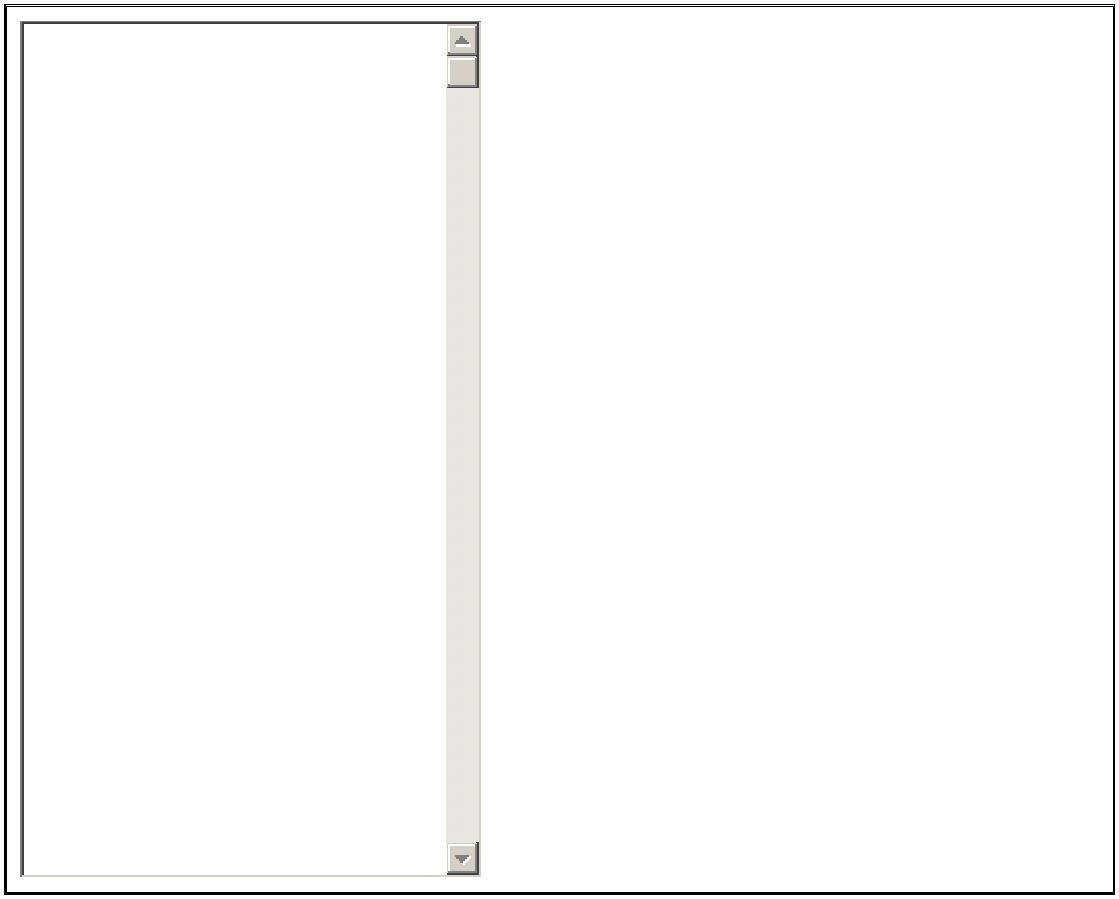
	1	2	3	4	5
a. Microsoft word or similar					
b. Excel or similar					
c. Blackboard					
d. E-mail					
e. Text messaging					
f. Internet					

g. Other (please state below)	○	○	○	○	○

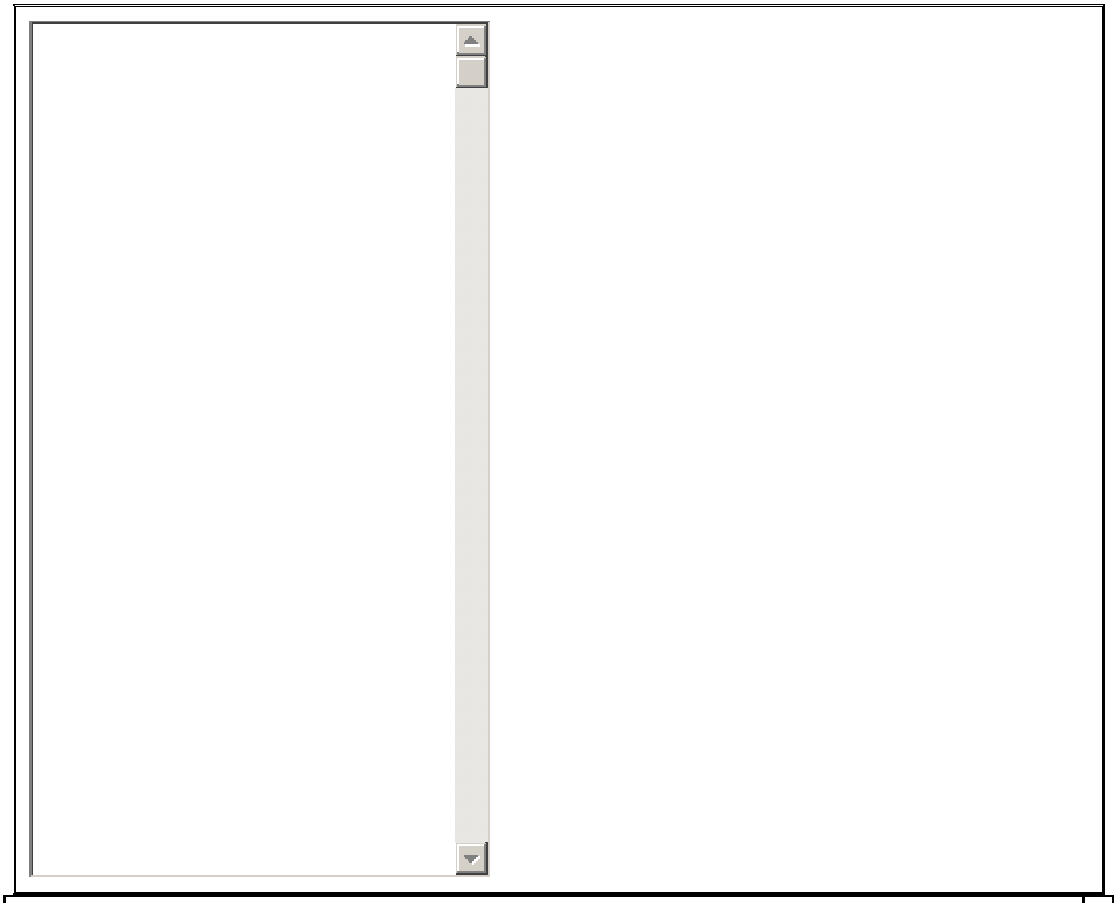
21. Please state other

22. If you could choose one piece of technology to support your learning here at the university, what would you choose and why?

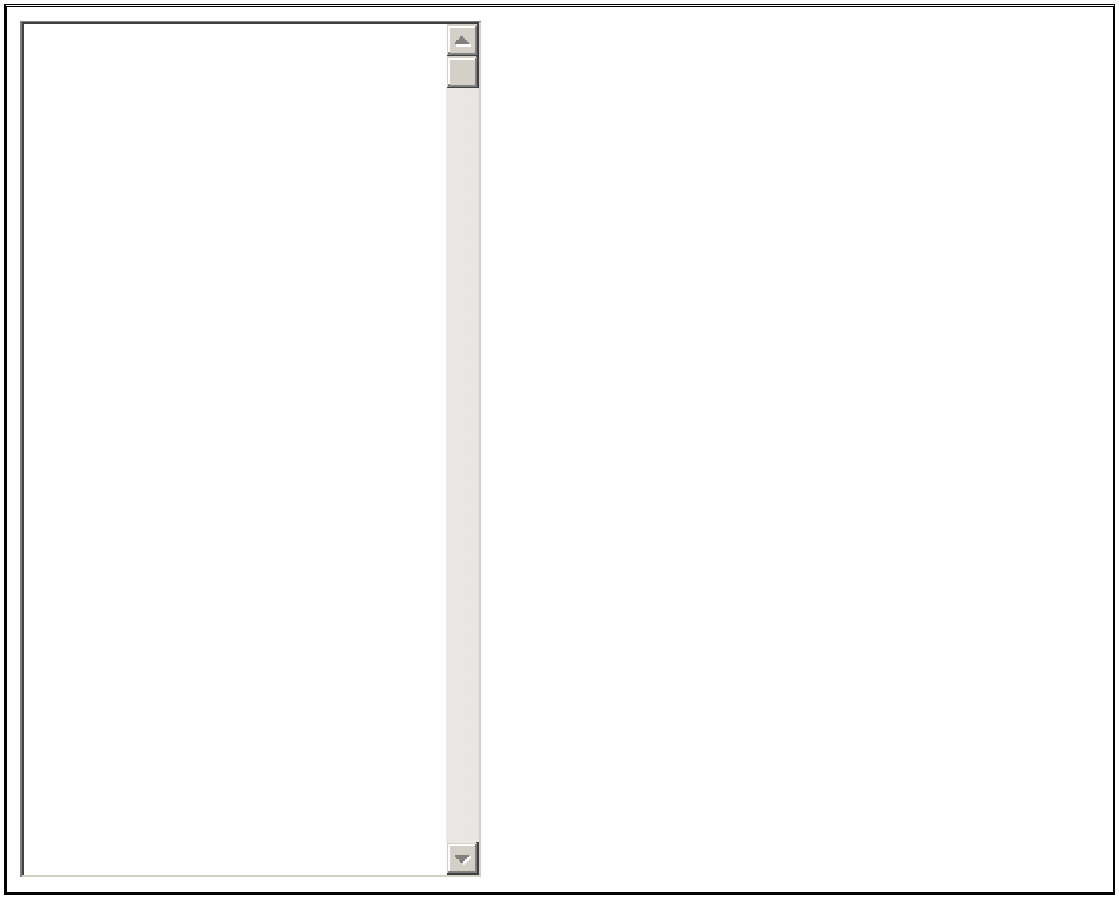
23. How could technology have supported your learning more on your present course?



	Your Recommendations
24. Thinking about how the University might best support student learning with technology in the future, what recommendations would you make generally?	



25. What recommendations would you make for using technologies to best support students' learning on this particular course in the future?



Thank you for completing this survey.
M Sheard
J. Ahmed
Z. Ali
The University of Huddersfield
School of Education and Professional Development